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FACTORY AND OFFICE ADMINISTRATION

BY

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MODERN BUSINESS

VOLUME 4

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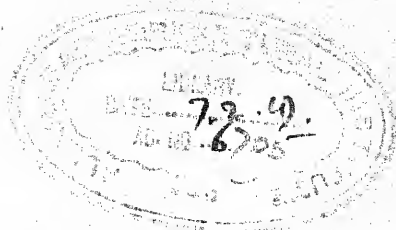
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PREFACE

Wilbur Wright once said that out of the sixty seconds in a minute an aviator is busily engaged for fifty-nine in keeping his machine on an even keel. A flying machine must always move in order to stay aloft. If it stops it falls.

Movement and balance are the two cardinal elements in a science of business administration; and eternal vigilance is the price which every manager must pay for progress in his business, and efficiency which comes from running smoothly.

In this book we are concerned primarily with the working of these principles in their application to the factory and the office. And while the main principles of management here laid down apply as well to other fields of business administration, their application is confined here to the functions of production and to those functions which coordinate the various activities necessary to promote accuracy and harmony in operations between departments, between men and between production and distribution elements of business, i. e., the office.

Sometimes a book can be described best by telling what it is not. This is especially true where the point of view in the book is new. The exposition of the

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principles of administration as they have been deduced from many kinds of social activity to the special field of business relations, has not been the usual method of presenting this subject.

Most books emphasise *system* and make only incidental reference to fundamental principles as may come from consigning this or that activity to the category of "good practice."

We have taken the opposite method of approach and recommend as good practice only those activities which conform to basic principles. By this method we have been able often to include both factory and office practice under the same general classification, and thus to eliminate the repetition which would come from treating each entirely separately.

The causes of industrial inefficiency appear to the author to be mental laziness, prejudice against so-called nonproductive labor and lack of foresight. Most men dislike to think, to risk money which does not go into assets which have value in case the enterprise is abandoned, or to balance the profits due to future savings against the immediate outlay. In presenting the material the author has had in mind these obstacles to the ready acceptance of the principles and methods of modern business administration.

LEE GALLOWAY.

New York.

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FACTORY AND OFFICE ADMINISTRATION

CHAPTER I

THE ERA OF THE ADMINISTRATOR

1. *Growth of industrial establishments.*—Mr. S. F. Bowser of Indiana started life hauling ice, conceived the idea of the self-measuring pump for distributing oil and gasoline, and from a room in a cow-shed developed a factory occupying twelve acres of floor space. His first machine was an improvised lathe operated from a belt driven by turning a wagon wheel. Twice his business has been completely wiped out by fire, but he has lived to see his employes number 1,600 and his sales amount to over \$4,000,000 a year.

We have in this illustration American business life epitomized. The man, the growth of the business and the complex problems which must have been involved, suggest the various elements which enter into the administrative activities of business life.

Industrial enterprise and the growth of business are world wide. The Willys-Overland Company of Toledo, Ohio, has so increased the use of electricity in its manufacturing processes that it now requires as much

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of it as a city of 250,000 inhabitants would for ordinary household purposes. The Ford Automobile Company uses a million cubic feet of gas a day—enough to supply a city of 100,000 people. The Cadbury Chocolate Works of Birmingham, England, have grown from a small industrial community composed of 300 persons in 1880, to the present urban proportions of nearly 7,000 employes. The Krupp Works at Essen, Germany, cover an area of 1,000 acres and employ over 35,000 persons.

2. *Private and public administration.*—In the use of equipment, power and material and in the number of people employed, many of the world's industrial establishments assume the proportions of city or state governments. From the viewpoint of size and the number of workers, the management of many modern factories involves administrative questions which a few years ago would have seemed applicable only to military or civil organization. Administration involves the velocity and the continuity of movements as well as their magnitude. When we take into consideration the intensity of activity in the different fields, the administrative problems which confront our municipal, state and military organizations pale beside those of industrial plants.

A department store turns over millions in stock every three months. An automobile factory makes a machine every sixty seconds. A printing press folds 1,500 papers a minute, year in, year out. Again, the success of business administration must be

judged by the standard, Does it pay in dollars and cents? Periods of accountability are sure and frequent. In this respect there is but slight similarity between the administration of an industrial unit which must draw its strength from within, and that of a civic or military unit which draws its resources from the pockets of an outside community or from the pillaged fields of the adversary. The mayor of a city appeals to his constituents once in one or two or more years; the military leader may never be brought to account for his methods; but a business administrator must account regularly for the profits of his concern.

Public and private administration deal with similar problems, and are guided by kindred principles of organization and operation, but the spur of competition and the desire for profit develop a far higher efficiency in the private field.

3. *Need of sound business methods not always realized.*—The industrial unit should be administered by a policy which is constructive, definite and responsible. It is reported that one large automobile concern decided to distribute \$10,000,000 surplus after one night's reflection on the part of the chief executive. The story is typical of the rapidity with which decisions are reached by men trained thru experience in the difficult task of administration. Such men sometimes believe that money can be made solely by energy and determination. They are not given to analysis and fail to realize how their own powers have grown as a result of the self-training they have given

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themselves, and are therefore indifferent to plans for scientific methods of administration. In the United States, business men have grown up in a young and loose industrial organization. There have been few great interests which could not be temporized with. There has always been a large margin of profit, and problems of external or internal policy or old abuses were seldom so pressing that it was not easier to take chances than to take pains.

4. *Weight of personality.*—When ignorance incurs few penalties, managers are prone to arrogate to themselves great wisdom. Too often the assumption of superior knowledge has stood in the way of progress in the study of business problems. Self-made men delight to discourse on personality, but seldom do they give the world the constructive ideas upon which real improvement of business administration depends. Thru the mere glorification of success, much of our business philosophy is made up of pernicious dogmatism. With it is sometimes found abstract speculation on practical business problems, since it is much easier to imagine an ideal business situation than to know the tendencies of actual conditions.

5. *Weight of economic forces.*—In the science of business administration the tendencies which have been noted have led to a confusion of issues, for in a science phrases and platitudes cannot be substituted for patient investigation and the analysis of facts. Civil and military necessities have compelled the state

and army authorities to study and classify their activities and experiences, and now economic pressure is forcing business executives to assume a similar attitude toward the administration of industry.

The whole tendency of economic development is to destroy the isolation of former periods. Men in the conduct of business are compassed about by general economic forces which they must dominate or to which they must adapt themselves. Whatever takes place in any part of the world has its echo, faint or penetrating, as the case may be, in the economic life of our nation. In the world-wide competition of modern times, mere money and dumb luck cannot be relied upon to give a man a place and keep him in it. Successful enterprise requires careful planning. Men may prepare for a business venture consciously or unconsciously, but there must be adequate preparation. More and more are men becoming aware of this need; more and more are they planning their business operations as an engineer plans his work.

6. *Opportunities of the present.*—The nineteenth century was the golden age of machinery and this age has not yet seen its close. Innumerable inventions found a field open for widespread utilization, and called for vast financial combinations. Thomas Edison's life work displays the possibilities in regard to the invention of new industrial equipment; the accomplishments of J. J. Hill and Andrew Carnegie show the possibilities of creation in commercial organization, and J. Pierpont Morgan's work epitomizes

constructive labor in the field of financial organization—all symbols of successful inventive effort.

Invention—the capacity to see new combinations—lies behind all human progress. In the past century invention was chiefly concerned with the advancement of the arts connected with machines, materials and money, but there is prospect of further industrial progress if inventive power is applied at a new point. In the industrial trinity of machines, money and men, men seem to have been neglected. The machine age with division of labor, has prepared the way for an administrative age where men and their cooperation will count most in advancing civilization. It is not unlikely that the men with inventive power, who will be rewarded most highly by society in the future, will be the business executives—the men who devote their creative and constructive energies to the problems of business and industrial organization and administration.

7. Importance of knowing the social trend.—The economic development of the last hundred years can be considered as the necessary preparation for a future in which administrative principles will play a larger part. This trend must be reckoned with. The young man who today prepares himself to become an expert watchmaker would find himself out of place in a land of dollar timepieces; and an office apprentice would be foolish to devote his life to rapid mental calculations in the day of the adding machine. Dazzled by the successes of men who led in

the industrial development of their day, many present-day youths, notwithstanding seek to emulate them by following the same course.

Past progress has been rightly attributed to "division of labor," but this principle, which solved so many problems in the past, seems to have lost some of its power under present conditions. It has not in fact lost force, but men have taken too narrow a view of specialization. The possibilities of the division of labor are far from exhausted. Specialization has entered the realm of administration, and the chances of success for men who see opportunities and possess the power of invention, i. e., the power of inventing administrative methods instead of devising new machines, have not become less numerous, tho they are found in a different and perhaps a higher field of business effort.

8. *Specialization develops organizing ability.*—The most recent development in the division of labor is the setting free of the organizing ability of mankind. When the workingman devoted his entire energy to making a living, he had little time for planning better ways of doing his work. A century of specialized labor, however, has given great numbers of men an opportunity to perfect new machines and combinations of processes which have greatly enriched society. To these men society has been willing to pay the price which all constructive ability can demand. Men who found better ways than their fathers ever dreamed of for producing, exchanging

and distributing commodities, have been richly rewarded. To this class belong the Vanderbilts, the Rockefellers, the Rothschilds, the Krupps and others like them.

9. *Need for leadership.*—As industrial and commercial enterprises expand, the demand for able leadership becomes more and more insistent. It is not only among the highest officials of the modern corporation that executive ability of a high order is required. There are many positions of lesser rank where men are charged with the handling of property and the control of men, on a scale which far exceeds that of the independent enterprises of earlier days. The large rewards in industry and commerce appear to be reserved for the executives who, in addition to the mechanical appliances which human ingenuity is constantly devising, bring to their task the ability to organize and to administer vast masses of capital and great numbers of laborers.

10. *What is administration?*—We have used the term administration as one which implies some degree of excellence and merit, and thruout this work shall continue to do so. Strictly speaking, the term is neutral; it means nothing more than the conduct or management of affairs. Whether guided by recklessness and ignorance, or by caution and wisdom, it is none the less administration. Since business is conducted for profit, and since bad administration cannot last, it is natural that the term business administration should carry the implication that it is backed by execu-

tive ability. It is therefore to be expected that our consideration of business administration should concern itself with the study of the successful conduct of business affairs.

We are concerned, therefore, with business that is guided by executive ability. No phrase is more commonly used and none more successfully eludes precise definition than the rare gift of executive ability. It is a compound of many things. Executive ability has sometimes been described as "letting others do the work." It would be more exact to say that such ability consists in doing nothing which others can do, and in selecting others who can do well the work intrusted to them. One might perhaps add that progress in executive authority consists in a nice discrimination as to what may safely be deputed to others, and what must be reserved for the leader.

11. *Test of the administrative function.*—The work of the executive often differs from that of his subordinates, less in the kind than in the degree of responsibility which is involved. The stenographer knows what limits are placed upon his activities; the man at the lathe is seldom troubled as to what constitutes his task. From the routine operations of the humblest workers to the activities of the directors of an enterprise, the duties of each position as it rises in the scale of responsibility seem to lose some degree of definiteness. This appears perfectly natural when we examine the nature of responsibility in business.

Company officials are fond of pointing out to their

subordinates the dire consequences which follow clerical errors. Mr. Smith of Wherenot, California, sends in his check for \$146.92 in full payment for goods ordered from the New York Suit Company. The cash clerk who enters the order carelessly omits to write the figure 1 in the amount, making it \$46.92. The order goes thru, but the credit department orders the goods shipped C.O.D., balance \$100.

Now Mr. Smith lives miles from the nearest railroad station—a three days' journey by wagon. The agent, in his notification of the arrival of the goods, supposing that Mr. Smith knows that \$100 is due, makes no mention of the fact. When Smith comes to the station for the goods, the agent refuses to deliver them, in spite of Smith's protest that the money has been paid in full in advance. Smith has to drive back—another three days' journey—and begin a painful correspondence with the New York firm. Of course, the cash clerk's mistake is found out and the railway agent is instructed to release the goods, but Smith must make another round trip of 180 miles. To square itself with Smith, the New York Suit Company pays Smith's expense bill of \$40 and presents him with a handsome watch besides, but it loses a customer.

The clerk has injured the standing of the house with the customer by a purely mechanical act which is definitely measurable in its results, i. e., leaving off the figure 1, and the consequent error of \$100 in the account loses a customer. The management hopes to

renew business relations with the customer and adopts measures to effect this. Here then rests the distinction between the functions of the clerk and those of the manager. The clerk has a definitely limited scope of activities; the manager deals with *relationships* which require the use of *judgment*. The broader the influence of the executive, the greater is his responsibility, and the higher is his position. The manager of the New York Suit Company handles Mr. Smith's case because of the responsibility involved—nothing less than the reputation of the house is at stake.

The difference between the position of the clerk and that of the superior officer does not lie in the fact that one attends to details while the other deals with general policies; the difference lies in the *kind* of details each handles. The duties of the cash clerk are those of routine, repetitive in nature and involving slight responsibility. The manager's duties also involve details, but these are symptomatic details, the handling of which involves heavy responsibilities. The clerk's error in detail caused the firm the loss of a few dollars and one customer. The manager's handling of that error was no less a detail, but the effects of a mistake on his part would have been immensely greater. In the one case, the effects of the detail are lost within the department, the office or the firm itself; in the other, the effects lie beyond the office or the factory and involve the good-will and policies of the company.

12. *Thought, the basis of administration.*—The National Cash Register Company has posted thruout its

plant the notice, *Think*. To many executives, discouraged by repeated efforts to awaken initiative in their employes, such a sign seems as appropriate as a display of Edison service in an institution for the blind. But telling men to think and getting no response is after all no test of men's ability to think. If there were not depths of reserve power in every man of which he is seldom conscious, it would be useless to discuss the essentials of administration. Why urge men to think if each is already working at the upper limit of his thinking power? Planning, giving orders and supervising belong to the higher planes of thinking and constitute administration. Planning, giving orders and supervising call for outlays of energy on the part of the administrator, of which the follower of routine has not the slightest conception. That is why the office and shop men never tire of gossiping about the boss and wondering, How does he hold down his job? or, What does he do to earn his salary?

Eight hours, a spot in the office or factory, a task—these constitute a "job" to most men. The energy required to do the jobs is unimportant. The men who do them soon forget that they have brains. They cease to want a position which calls for administrative qualities. Yet because thousands of others have deep layers of energy and reserve powers for reasoning, it is worth while to point out the essentials of administration—the goal toward which every *thinking* business man has a right to work, a field that is

always open to those men who, tapping the hidden sources of their energies, are ever ready to mature plans, give orders with judgment and supervise efficiently the affairs of a big business.

REVIEW

What business influences have compelled the adoption of new policies of administration?

Compare the standards used in judging the results of civil and military methods of administration with those of purely business enterprises.

Why are business methods based on personality giving way to methods founded on constructive ideas and scientific research?

What great responsibility is society placing upon the business man of today? What will be his reward?

Show that the distinction between the work of a clerk and the work of a manager is not described by the word "detail."

CHAPTER II

PLANNING

1. *Administration in peace and war.*—Tho one administrator may be concerned with the conduct of some vast industrial enterprise, another may direct the operations of a city or state, while a third may be intrusted with military operations vital to the life or prosperity of his country; these tasks are essentially similar. To seek maxims for the conduct of business from the exploits and methods of great military commanders might seem at first blush incongruous. If we refer to military information for the principles underlying administration in general, it is because all administration is akin and because the records of war are far more complete than those of peace. In recounting the story of national strife no detail escapes attention. No phase of human activity is so well known down to the last order and report as the manner in which the great struggles of history have been carried on. Around them cluster a vast mass of official record and personal reminiscence, from which the student of a later day can vividly reconstruct the events of the past.

Perhaps the most picturesque figure of military history is Napoleon, and we shall draw largely upon his methods and experience to illustrate the general prin-

ciples of administration. In war the first element of success is a well-concerted plan of action, and that this is fundamental for business administration is obvious.

2. *Napoleon's success due to administrative planning.*—"The Emperor," says a biographer of Napoleon, "spent his life in his study. . . . One may say that all the other circumstances of his life were merely digressions." This is putting it strongly to those who think only of the Man on Horseback, but herein undoubtedly lay the secret of Napoleon's success as a military administrator. To his military and civil administration his study was what the planning department of the General Electric Company at Schenectady is to the managers of that corporation.

Planning preceded everything in the work of Napoleon. In the midst of his campaign or in directing the destinies of France from his palace of the Tuileries we find him planning. While allies and enemies slept at midnight, the Emperor was found bending over his maps "illuminated by twenty candles," meditating, deciding, dictating orders.

3. *Napoleon, planner as well as dictator.*—Napoleon did not observe the conventional methods of his day, nor was his brilliant success merely the result of the inspiration of genius without careful forethought. Those who admire his brilliancy, those who counsel others to ride rough-shod, like him, to their goal, think of him as the great commander, the dictator. They too often forget that planning was one

of the factors responsible for Napoleon's success. Many persons in administrative positions believe themselves to be real leaders, when they are only dictators, leaving it to others to originate measures while they merely criticize.

Modern administrators often seek to prove by citing Napoleon's example, that great administrators have a genius for details. This false conclusion rests upon the failure to distinguish between what Napoleon was compelled to do, and what he would have done had he been surrounded by men to whom he could intrust the execution of details. The genius of a leader lies in his ability to distinguish between the details which as manager he must handle himself, and those of the routine class which belong to operation and not to administration. The importance of details is not measured by the size of the units which are involved.

4. *Planning adjusts details to principles.*—To plan is to separate the essential from the non-essential, but to make this separation the administrator must have a few indestructible principles which act as crucibles for dissolving details. Napoleon's fundamental rule was simple. "The most difficult thing," he said, "is to discover the enemy's plans, and to detect the truth in all the reports one receives; the rest requires only common sense."

When he had analyzed all details and decided upon a line of action, the execution of his plans was as simple in outline as his method of planning. First, he

stated, "I converged all my forces on the point I wished to force"; secondly, it was his principle, "to begin the fight and get in as many blows as possible—the offensive in dead earnest along the whole line," and finally his rule provided that "at the weak point and at the moment chosen by him, the General-in-chief should give the formidable and decisive blow which overthrows his adversary."

5. *Collaboration in planning.*—The strength of Napoleon lay in his planning; his weakness, in the effort to do his planning without aid. The German General Staff has learned to overcome this weakness in war. American business men are learning to overcome it in industry and commerce.

In administrative planning collaboration is as new as are controlling accounts in bookkeeping. In both cases the necessity of keeping check on numberless details at long range has raised the newer methods almost to a par with the principles of planning and of bookkeeping. War, politics and business have undergone great changes, and conditions of administration have been much altered.

The conditions which confronted Napoleon in his administrative labors precluded collaboration. They called for a centralized control. In recognizing this he planned the maneuver which won the day at Jena and Austerlitz—only by one mind could such masterpieces of achievement be planned and carried to fruition.

Centralized control and personal leadership were

the principles of scientific management which Napoleon introduced into the administration of his day. His adversaries followed traditional methods, and their controversy in the councils of war killed originality of thought, retarded decisions, led to compromises, postponed solutions, and deferred the grasping of opportunities until it was too late to use them. Business men who are disposed to jump at such new ideas as committee systems of management and the like, but who have neither a planning system, nor an environment in which such ideas will bring forth fruit, would do well to study the "committee system" in war, as applied in the councils of Napoleon's adversaries.

The life and methods of Napoleon show the heights to which centralized control and personal authority may go, but they also mark their limitations.

6. *Lesson of these analogies.*—Only so far as these illustrations are paralleled in business affairs are they of importance here. In 1800, big business meant an investment of a few hundred thousand dollars, at the most, and the employment perhaps of a few hundred workers. Such conditions might well call for a centralized administration, or as Napoleon put it, "being personally present during the whole day in that corner of the battlefield where it is presumed that the decisive blow will be given." But today's business enterprises compete on battle lines which reach around the world. An American department

store may operate carpet mills in Persia, lace works in Brussels, and sell by mail order in Russia and Australia. Modern corporations operate under one control, mines, railways, steamship lines, stores and factories spread over a continent. No one man, without collaboration, could control such vast enterprises. The staff of experts has become as necessary in business as in military administration.

Machiavelli said that only one should command in war; that several minds weaken an army, but this maxim is of doubtful application to the huge enterprises of today in war or business. Millions of men are engaged in warfare. In commerce even so simple a matter as selling groceries is often conducted in chain stores extending across a continent. These conditions have brought about a new leadership in which the decisions and orders of the leaders are the result of conferences among a number of experts. This was exemplified in the great organization guided by Moltke in the Franco-Prussian War and has received illustration in a different field in the conduct, since 1900, of the German chemical industry.

7. *Newer methods make slow progress.*—That any form of collaboration in determining policies and directing the activities of a business has advantages is an idea which makes slow progress toward recognition. Labor leaders and many conservative executives look askance at any such plan. They are at a loss to understand how business can succeed without a

dominating personal leader in whom the members of the organization implicitly relied, and whom they would follow with zeal and enthusiasm.

Newer methods appear to lack force. The substitution of an executive committee for a personal leader has often weakened the energies of office, shop or selling forces. While it would be idle to minimize what the personality of the leader has accomplished, there are requirements of modern administration which personal leadership alone cannot fill.

In passing to newer methods it is highly desirable that a concern make the transition in such a way that, while the collaboration principle involved in the staff conference is adopted, the advantages which come from the personal work of the leader be not lost. The expert staff depends for its efficiency on the application of the principle of division of labor, on the development of initiative and on a wide diffusion of knowledge and democracy among all employes. The personal leader relies upon concentrated power, unceasing activity and the ability to awaken and sustain feelings of loyalty, duty and self-sacrifice among his men.

In adopting the staff conference in administrative matters, there is danger that composite opinion may be uncertain and decisions flabby. In such a case the attempt to retain the advantage of personal direction by issuing the staff orders in the name of the general manager usually fails. The manager loses enthusiasm when he thus fathers orders which are not his

own. Employees are quick to note any lack of interest on the part of the manager and to reflect the same spirit in their work.

8. *Pressure of general economic problems.*—There is a vital weakness in the administrative organization of our business concerns. Efforts to develop harmonious cooperation between the men who plan and command, and the men who take orders and operate the business machinery, are often unsuccessful. Even a leader of the highest rank finds it difficult to sustain year in and year out the high ideals of duty, loyalty and sacrifice necessary to the most efficient operation of a modern business organization. Nor can staff organization, or functional management as it is called when the same principles are applied to factory and office operation, accomplish these results among a great body of workmen, when their energies are exhausted by monotonous work, and their loyalty is weakened by appeals of trade-unions whose aims are not in harmony with company policies.

Perhaps the greatest problems of business administration are not those of internal organization, but those which spring from general economic and social conditions. While these problems remain unsolved, an element of mere expediency exists in all efforts to secure cooperation within the organization. Bonus systems, profit-sharing schemes and copartnership plans are some of the evidences of the external pressure. Too often they are adopted without proper consideration of their relation to the general economic

problems. A manager may find his organization working inefficiently, and to meet his own pressing internal needs may adopt some such scheme in an imperfected state, often taking it bodily from some other concern, which has taken it up with as slight deliberation as himself. From such action we get piece-rate wage systems which are ineffective, welfare programs which degenerate into fox-trot parties, and pension systems which put a premium on senility, simply because there has been no adequate planning and no proper adjustment of the means adopted to the end proposed.

The problems of administrative planning are of three general classes. One chiefly concerns the employer and executive; a second embraces production and distribution—problems of machinery and men; while the third involves the relation of business organization to the whole political and industrial system.

REVIEW

Contrast the principles of administration involved in supervising the deposit of a check for \$100,000, and the answering of an overcharge complaint on a gas bill for 40 cents.

What principles used by Napoleon might well serve as the basis of business strategy?

A business executive refuses to consult his experts, superintendents, foremen and others in forming his policies. Is this an evidence of being a strong executive?

A large tobacco company has many hundreds of retail stores thruout the country. What effect do size, distance, amount of business, etc., have upon the character of the control—i.e., will it tend toward collaboration on the part of the executives or toward centralized personal control? Why?

A corporation adopted the executive committee system of

management. To overcome the objections of issuing orders in the committee's name, the orders were given out over the name of the general manager. It was noticed that the enthusiasm of both manager and men soon dwindled. What were the reasons for this result?

CHAPTER III

EXECUTIVE ORDERS

1. *Orders: the result of planning.*—"When at the dead of night," wrote Napoleon, "a good idea flashes thru my brain, the order is given in a quarter of an hour, and in half an hour it is being carried out by the outposts." In civil administration giving orders is so often tied up with red tape that the time lost far outweighs the advantage of having checks to avoid errors. Nor is the curse of red tape confined to older communities. Witness the experience of a postmaster under the Commonwealth of Australia who wanted to have a table made. An official report records the correspondence as follows:

Postmaster to Postal Inspector, date June 25th.

Postal Inspector to Deputy Postmaster-General, date June 29th.

Deputy Postmaster-General to Works Director, date July 2nd.

Works Director to District Inspector for report and estimate, date July 8th.

District Inspector to Works Director, date July 15th.

Works Director to Deputy Postmaster-General, date July 17th.

Deputy Postmaster-General to Postal Inspector, date July 21st.

Postal Inspector to Deputy Postmaster-General, date July 22nd.

Deputy Postmaster-General to Works Director, date July 26th.

Works Director to Accounts Branch, date July 28th.

Accounts Branch to Works Director, date August 6th.

Works Director to District Inspector, for action, date August 13th.

“Seven precious weeks to have a table made,” says the report.

If the first step in administration is planning, the second is issuing orders. A decision having been reached, orders must be given. Leaders in war, rulers of nations, and managers of business may spurn collaboration when they are formulating their plans, but they cannot do without assistance when they issue orders. Even Napoleon, who “not only took the initiative, in thought, but also attended personally to the details of every piece of business,” developed a rudimentary staff, whose business it was to take orders and see that they were delivered. Yet neither Berthier nor Talleyrand ever gave an order or wrote a dispatch which had not been dictated by Napoleon. If, instead of military commander and emperor, Napoleon had been a railroad magnate, Berthier his chief of staff and Talleyrand his secretary of state would have been glorified train dispatchers.

2. *Fundamentals in organization.*—When one man attempts, as did Napoleon, to shoulder all the responsibility, we may have an effective business machine so long as his health and energy endure, but organization will be lacking. Especially in execution does

organization imply a division of responsibility. It is, in fact, the cooperation of subordinate chiefs, each with a limited field of action within which he is responsible, which constitutes organization. Under such a system the executive has so classified the essentials of his business that the necessary commands and orders originate at the natural source of supreme or subordinate authority according to their importance, and are issued by the authority which can supervise them most effectively.

3. *Organization of executive work.*—The great executive delegates the superintendence of subordinate activities to others, but he realizes, like Napoleon, that he is “the greatest slave of all mankind, obliged to obey a master who is heartless, the calculation of events and the nature of things.” To control these events and master the nature of things, the executive builds up an organization which will take care of details without his personal intervention, and thus leave him free to work out his larger problems.

The principle may be illustrated in the small detail of office correspondence. This may be so arranged that only the most important matters come to the attention of the manager, by some such procedure as the following:

1. An office employe sorts the mail.
2. Certain letters need only the manager's attention, and are turned over to him for his careful consideration.
3. Some letters contain only certain sections that

need his attention. These are checked, so that he may come to the point without unnecessary reading.

4. Notes are made of other letters that deal with certain points which must come to his attention.

5. Many letters do not need to be considered by him at all. Routine letters thus can go to the proper department at once.

Following similar principles, the executive does not himself issue every order but only certain ones; he does not run to the files or record books but has them put on his desk; he does not construct tables of figures from a mass of records before him, but studies the totals of results, charted by someone else for his ready comprehension.

4. *Classes of orders.*—Orders issued by the executive must be clear and explicit if the expected results are to follow. Orders, it will be found, are of two distinct classes—one designed to produce general efforts, the other directed to the performance of typical tasks. A military commander divides his orders into general orders and special orders; a general manager in business speaks of shop and office policies, and production orders and office instructions.

In order that we may make this distinction clear, we shall again revert to military history. Let us examine a general order issued by Napoleon to his chief of staff, and then trace its further developments into a series of special orders to the several commanders involved.

5. *An example of general orders.*—On October 12,

1806, having decided to strike the Prussians at Jena, Napoleon gave his general orders to Berthier. Remembering that his principles of war were concentration of forces and rapidity and secrecy of movement, we observe that these orders are the clear and concise expression of the Emperor's purpose—about 150 words in all, yet embracing general orders for seven commanders:

Give orders to Marshal Davout to leave his position for Naumberg, where he must arrive as quickly as possible, but always holding his troops ready to fight. He will be preceded by all his light cavalry, which will send out skirmishers as far as possible, as much for the purpose of obtaining news of the enemy as to make prisoners, stop baggage and get accurate information.

General Sahuc's division of dragoons will be under his orders. It will proceed to Mittel-Pölnitz where it will receive Marshal Davout's orders. Prince Murat and Marshal Bernadotte are also ordered to Naumberg, but are to follow on the Zeitz road.

Marshal Lennes proceeds from Neustadt to Jena, Marshal Angereu proceeds to Kahla, Marshal Ney will be at Mittel-Pölnitz. Headquarters will be at Gera, noon.

Give orders for sending off of the divisions of heavy cavalry and the divisions of dragoons which have remained in the rear, as well as the park of artillery, to Gera.

6. *General orders converted into special orders.*—Berthier, the chief of staff, having received Napoleon's general orders, proceeded to write to each of the commanders those instructions which pertained specifically to him. Taking as an example Berthier's special order to Marshal Davout, we find that hardly

a word is added to the general orders—such was Napoleon's method in this one-man type of management.

A few hours later, Davout, having received his orders, immediately assembled his troops and gave them their instructions regarding: 1, the route to be followed; 2, the order of march (first, second, third division, etc.); 3, the formation of the troops (in a mass).

7. Strength and weakness of these orders.—The success of Napoleon's method depended upon the secrecy and rapidity with which orders were carried out. On an average of two hours after the receipt of the army orders by the commander of a corps, the troops were in motion.

The weakness of the method is evidenced by an examination of the orders which he issued. These special orders, as Colonel Vachee in his "Napoleon at Work," says,

Show by their tone the incorrectness of style, the numerous omissions, that they were written by secretaries after the dictation of Berthier, who had before him the Emperor's general order, which he occasionally completed by drawing upon information received verbally and perhaps set down in his green notebook.

A glance will show that this method lent itself to a multiplication of omissions and an increasing of errors. Vachee says further:

These orders, altho verbose, contained little; the object of the march, the position of the army and, in the case of the corps in the front line, instructions to obtain information

concerning the enemy. But as to what the general-in-chief himself knew about the enemy, as to the ensemble of the projected maneuver and the mission of each corps in that maneuver, there is no mention. . . . the commanders were marching in the dark and could with difficulty show initiative. There was no indication as to either zones covered while on the march or the routes to be followed by each of the army corps. The commanders of the corps chose the roads leading to destinations fixed for them and sent in the information to imperial headquarters.

If we wish to get the full significance of this passage, as it might apply to any administrative activity in business, we may reread it, substituting for the words, *march, army, corps, enemy, general-in-chief, maneuver, commanders, imperial*, the words: *sales, sales organization, salesmen, competitors, general manager, campaign, sales agents, corporation*. With these substitutions, the passage reads like a modern auditor's report explaining the causes for the bankruptcy of some business concern which he has examined.

8. *Napoleon's methods not practicable for smaller men.*—Men with but a fraction of his genius have believed themselves Napoleons in war and in business. They have believed that only thru one master mind could operations be successfully conducted, and have been equally sure that theirs was the master mind. They have not reckoned with the fact that many types of modern business demand for their conduct a labor which exceeds the physical and intellectual force of any one man; they call for administrative methods

which involve the employment of numerous staff officers, experts who have the confidence of the general manager.

In the larger concerns of today no simple form of organization could be applied, and even lesser concerns are coming more and more to recognize the advantages of effective organization.

9. *Improvised administration.*—If collaboration in administrative planning, orders and supervision work so well, one might well ask why Napoleon did not adopt it. Why, if the excellence of such methods is so great, have they not been more widely adopted by business men in all parts of the world?

The answer to the first question is that the scientific method of preparation takes time. Neither in France nor in the countries opposing her did the military situation in the Napoleonic era admit of the slow collaboration method of preparation.

Nor is the answer to the second question different. Men shrink from the labor of reorganizing going concerns. The business man recognizes that such a reorganization involves a greater reliance upon the judgment of others. He is doubtful whether he can find men upon whom he can rely. If he trains them up in his own business he knows only too well that staff officials who possess sufficient information and judgment to work out complicated problems in their departments, and who can collaborate with intelligence and sympathy in building up general policies, are but slowly developed.

If military organization has gone further than business, in systematic preparation for the emergencies which may call it into action, it is because it is easier to convince a nation of a public need than to impress upon successful men of business the value of new forms of carrying on their work.

REVIEW

In giving orders, what advantages come from having the execution follow as soon as possible a decision to act?

How would you, as a business executive, apply to yourself the words of Napoleon who said, "I am the greatest slave of all mankind, obliged to obey a master who is heartless, the calculation of events and the nature of things"?

State the advantages which come to an executive from so arranging his daily work that it permits him to hit the highest and most important spot first.

As a business man, criticize the order given by Napoleon to Berthier (page 28).

Why should the factory or office executives be thoroly trained in administrative policies before a highly specialized functional control is adopted in place of the centralized, personal management?

CHAPTER IV

EXECUTIVE SUPERVISION

1. *Third function in leadership.*—In all forms of administration there are three elements which are always present—planning, giving orders and supervision. Two of them have been discussed and it now remains to consider the third. The order in which they have been named indicates not only their sequence in time, but also, in the judgment of the best thinkers of today, their order of importance.

Giving planning the first place and relegating supervision to a third, runs counter to the general opinion of the past, one which is widely held at present. Many are still disposed to place the greater emphasis on supervisory and directing activities. They think of the executive as seeing that his orders are carried out, they picture the manager as in the midst of affairs directing one man, correcting another—the center about which all the activities are grouped.

2. *Conditions calling for direct supervision.*—Earlier military and industrial activities could prosper only with highly developed direct supervision; improvised methods called, of necessity, for continuous and strenuous activity on the part of those in control. The qualities which made these activities fruitful were

extolled as executive virtues. Ability to command; to instil fear; to inspire enthusiasm; to "get action"; to show results; in such terms was executive ability described.

Under modern conditions planning is receiving larger recognition as the chief element in administration. "A wise direction is of more avail than overwhelming numbers, sound strategy than the most perfect armament"; or, if we wish to carry the figure into the field of industry, "a wise policy is of more avail than a large plant, good management than perfect equipment." But wise policies and good management are the result of thoughtful reasoning rather than of improvised expedients.

3. *Limitations in administrative supervision.*—It is a not infrequent failing among administrators to assume responsibilities for which they are not fitted, and to take over the direction of affairs in which they are not expert, merely because their position gives them the power to do so. In national life, military organization and operation are held to be subordinate to the aims of diplomacy. Yet no diplomat would attempt the supervision of armies in a campaign. In industry, on the other hand, those who manage the finances and control general policies, sometimes feel that they can with equal facility manage the operations of the plant and of the sales department. In many cases this may be true, but the possession of power does not necessarily imply the capacity to use it intelligently.

Supervision, like planning and giving orders, in-

cludes a variety of activities. If this part of administration is to be well conducted, there must be a clear understanding of these activities and their mutual relations. When this is had specialization appears. Authority and responsibility, general matters and routine details are so distinguished that the several spheres of supervision become arranged as a perfect system, providing "an avenue," as Professor E. D. Jones says, "for the downward passage of ideas associated with initiative, and the upward movement of facts connected with response."

4. *Supervision involves different grades of authority.*—A proper organization of supervision involves the marking out of boundaries between the functions of persons with various grades of authority. From the president to the shipping-clerk, the giving of orders and the supervision thru inspection and reports form themselves into a system whereby supervision is effected from the top to the bottom, from the receipt of the sales order to the shipment of the goods and the payment for them.

The details of such organization must be left for a later chapter. But whether the task be that of a general manager or of an office boy, it should be governed by certain principles of sound administration. What these principles are we may now inquire.

5. *First principles of supervision.*—One authority wrote concerning an army, "Every one must remain within the boundaries of his duties, otherwise everything will be confusion." This implies first, the plac-

ing of responsibility, and secondly, the clear definition of the boundaries of each authority. Like principles should guide supervision in business affairs. Each superior officer, foreman, department chief, general chief should have a definite authority, superior so far as it goes, but clearly limited in its relations to that of other officers. When a business is so organized, when we find no overlapping of functions and no contentions among officers as to their duties, it can be so guided as to carry out effectively the general policies which emanate from the chief executive.

It is the part of the general manager to supply the unifying element. Allowing subordinates a reasonable opportunity to exercise initiative does not dispense with the need for general control. The supervision of the general manager aims to stimulate activity and to coordinate the efforts of all so as to secure the desired results. The head of each unit of supervision must take part in the execution of orders, if he would give to the men in his charge the impetus necessary to fruitful effort.

Such an impetus comes from constant and friendly watching of the men, inspiring them thru the offer of rewards, encouraging the diligent, by repressing the idle and the careless thru appropriate penalties.

6. *The master's eye.*—System may provide an excellent plan of control, but it is of little avail without the "eye of the master." Orders are useless unless carried out; reports mean nothing unless acted upon. It is well for the "master's eye" to be diligent in

watching the business, but if the manager attempts to supervise every possible detail, he is apt to find that he has little time for weightier matters. Proper planning will not overburden the manager, but will enable the "master's eye" to see all events that possess any significance.

It is not to be denied that some managers appear to succeed thru the sheer force of personal activity. They want to see things for themselves, they follow orders closely, and inspect repeatedly until the desired result is accomplished. Some old-time executives may have carried this method too far, but their practice may still serve as a lesson for managers who reduce their physical activities to sitting in a handsome office and pushing a button, and for department heads who confuse seclusion from their men with exclusion of details. Heads and heels both play a part in proper supervision and neither can be neglected with impunity.

7. *Expectation of surprises.*—We often compare man's life to a book. The comparison is good. The events of life are the stuff that books are made of. If the author would interest his reader, however, he must arrange his story so as to surprise him continually. It is the unexpected that keys all men to the sticking point. Surprise is as necessary, too, in keeping men interested in their work as in holding the interest of the reader in his book. Supervision which neglects the element of surprise fails in its purpose.

Important as this element of administrative pro-

cedure is, it is a mistake to attain it at the expense of other and perhaps equally important principles. Foremen sometimes seek this element of surprise by looking thru keyholes or slipping unnoticed into rooms in order to "get the goods on the men." They may get what they want, but in so doing they sacrifice something which is priceless—the good-will and confidence of the men.

It is not necessary to resort to underhand methods to introduce into inspection the element of surprise which saves it from becoming a deadening and ineffective routine. Napoleon was always doing the unexpected. In his inspection he came and went before men were aware. He was thoro, but added the unexpected. Finding a sentry asleep at his post, he took his gun and stood guard until the weary soldier awoke. Reviewing his troops, he asked unexpected questions of his officers. The routine method would have demanded that the commander-in-chief gallop more or less brilliantly in front of the men, but not so with Napoleon. Stopping in front of a colonel, he asked, "What is your effective force? How many men have you in hospital? At the depot? And how many sick in camp or how many absent from any other cause?" One can easily understand how such methods kept men and officers continually on the alert. Each one felt that the Emperor had his eye on him, and each stood in constant expectation of a surprise.

8. *Supervision by inspection.*—A supervisory unit should not be extended in its operations beyond the

point where it can do well the work intrusted to it. If the proper quality of output cannot be had, or if the men cannot be keyed up to their full working capacity, the unit is too large. It should be of a size to permit fruitful personal inspection, which can bring all matters to the attention of the manager. No business, however, can afford a system of supervision which calls for the master's personal inspection at every turn, and reliance must be had upon subordinates.

If planning outlines, the direction of supervision inspection furnishes the test of adequate control. The executive, therefore, who can control effectively only thru personal inspection must have his authority curtailed accordingly. The test of modern factory and office efficiency is measured by the extent to which inspection can be stretched and still maintain adequate control. One minute of a ten-thousand-dollar expert's time may be so utilized as to affect the activities of a whole department.

9. *Symptomatic details.*—An office manager steps into a department, gives a glance and departs. A stranger in so brief a time would have seen nothing; the experienced eye of the executive has caught essential points by which he judges the whole. The details by which a physician judges the condition of his patient are called symptomatic details, and the same expression may properly be applied to the signs by which the administrator of a business concern judges its activities.

One of Napoleon's principal anxieties was the number of available combatants. Continually on the lookout for any symptom showing the changes in the number of his men, he studied the muster rolls from one to two hours every day until the twenty thick volumes which came to him every month were analyzed. "I leave everything else," said he, "to see the difference between one month and another." Thus the leader was able to verify the execution of his orders and the force available for carrying them out, altho he was not always able to be present.

Shop and office executives must likewise examine their muster rolls if they would impress their subordinates with evidence of their vigilance. Orders given in their names must be checked, and that this may be done economically and efficiently the supervision must be carried on by calculations based on the selection and observation of symptomatic details.

If supervision is to be efficient, its nature, its limitations and the essential elements of the different methods must be studied. Thus we find that supervision resolves itself into that factor of administration whereby the functions of control and direction are so distributed and coordinated that the greatest economy of time, effort and expense may be achieved thru the cooperation of all the units, and yet without destroying the initiative of any subordinate unit.

But an esprit de corps is as necessary as initiative and mechanical cooperation. This is gained thru the inspiration of the master spirit in supervision, be he

chief clerk in the dictaphone department or general manager, for upon him depends the unity which ability and open-mindedness in the leader can alone inspire. Given these qualities in a manager, the essential elements in supervision, such as surprise, inspection and rewards and penalties, adapt themselves to methods best suited to the circumstances engendered by local conditions. Tact, courage, courtesy and all the other qualifications of a successful manager are drawn upon as the occasion requires, and as these are induced naturally, the acts of giving orders, inspection and the bestowing of rewards and penalties reduce friction to the minimum while contributing to the general spreading of good-will.

REVIEW

How may an organization provide for the placing of responsibility and at the same time get the unifying element of an administrator's personality?

State the limitations, as you see them, to the purely mechanical means of supervision.

Show how the element of surprise in management keeps the employe on the alert.

What relation does the expert bear to inspection in modern factory or office management?

What are some of the "symptoms" by which a superintendent may judge the conditions of a department?

CHAPTER V

REWARDS AND PENALTIES

1. *Fear and interest.*—Most men who are in authority in factory and office are consciously or unconsciously guided in their administration by the feeling that the two levers which move men are fear and interest. They believe that no man shows zeal unless he is anxious, and according to their native bent strive to change this anxiety into the fear of punishment or the hope of reward.

Two leading methods of administration result; first ruling by division, and second, rewarding by titles and prizes. Such methods rely for their success on an appeal to man's imagination or his vanity, rather than on an understanding of the deep-lying sense of what is right and just.

2. *Ruling by division.*—There is an old Latin maxim that "He who would rule should divide." It expresses the fact that when men are divided in their interests they are unable to make common cause against their leader, and thus the leader's position is secure.

While visiting a large factory in Brussels, an investigator was told by the works' manager that he relied chiefly upon this administrative policy. The visitor's note-book contains the following comment: "A

manager of superior capacities, yet fearing every form of superiority in his subordinates. He seems secure, but is surrounded by an atmosphere of jealousy, servility and anxiety."

This method is based on the weakness of human nature, and not on its strength. Instead of seeking to preserve independence of character and thought among his men, and then welding their labor into one unified effort, this manager adopted a cheaper means, which obtained unity of action only so long as the master's prestige remained intact. Fear may be a powerful motive to action but it is not one upon which a permanent organization can be successfully founded.

3. *Prizes and distinctions.*—The appeal to fear brings eye and lip service but it takes the heart out of man, and one whose heart is not in his work cannot accomplish much. Far more effective is the method of rewarding good service by prizes and distinctions. The business world swarms with promotion plans, wage schemes, profit-sharing systems and bonus quota and prize rewards, all of which have for their aim to bring out men's effort by enlisting a personal interest. If a salesman makes a good record he is put in a special class, and may be given a particular district as a special honor. His picture appears on the first page of the house organ, he receives a prize of a gold watch, and so on. The material reward is often of slight value; it is the distinction which is prized. Someone made the objection to Napoleon that the crosses and ribbons of the Legion of Honor which he founded

were mere baubles. "You call them baubles," he said; "well, it is with baubles that men are led."

Whether or not these adjuncts to business administration are to be commended depends altogether upon the spirit which is behind them. If they appeal merely to cupidity and vanity they are not an effective force for permanent results. They must be means to an end, and that end must be the cultivation of interest in and loyalty to the organization.

4. *Associated interests*.—No system of rewards is vitalizing unless it is permeated with the spirit of associated interests. Unless it aids to induce among all the members of the organization, no matter how humble, the feeling that their interests are wrapped up in the welfare of the whole, it will fail to reach the highest efficiency. It is toward this ideal that intelligent business administration is constantly striving. In the measure that it consciously fosters this spirit, it rises above low standards. It discards the cynical attitude so often expressed in the phrase "business is business," and adopts in its stead the view that all concerned, capitalist, administrator and employe are cooperating in a common effort, from which each shall draw the reward which is properly due him and in which each should feel the true enthusiasm which springs from creative effort.

5. *Moral basis of discipline*.—"My factory is just like one big family," said the manager to a visitor as they walked thru the Port Sunlight soap works in

England. He had in mind the spirit of freedom and contentment which should accompany home life. He suggested something further. The home presents the highest development of social adjustments. The administrator feels instinctively that he will not have a finely adjusted and perfectly articulated labor organization until similar adjustments have been made. He is reaching out for some moral basis of control which will adjust the employe to his fellow-workers and to his job in such a way that discipline is produced, not thru external authority, but thru internal impulses.

6. *Administrative responsibility.*—Every football coach applies two tests in selecting his men. First, Will the candidate play the game for the benefit of the team and not try to star? Second, Can he be depended upon to attempt the seemingly impossible in an emergency? These are stringent moral tests which apply to the factory and office as well as to a football team. The coach must make each man feel "This is *my* position." He encourages each player to throw into his work all his energy, but not until the "position" becomes a literal part of him does he permit a player to speak of "*my* position."

The subtlest task in the field of administration is to turn "*the* job" of each worker into "*his* job." To call out, train and reward the best and highest in men calls for the best resources of an administrator. That the importance of the task is being recognized is seen

in the appearance of a new administrative expert concerned wholly with the selection and training of employes.

7. *Expert in labor selection.*—The appearance of the expert in any field of action indicates that it is no longer economical to depend upon traditional methods in directing important affairs. It is only gradually, however, that this fact has been recognized. Not until after years of struggle have the lawyer, the doctor and the engineer come into reputable standing.

A like struggle must be encountered by the business expert who presumes to act as a specialist on employment relations. Two strong forces are, however, compelling both factory and office to give careful consideration to the selection, training and holding of their employes. One force is the trade-union which works outside the organization; the other is the analysis of the labor "turnover" within the organization.

8. *Industrial counselor.*—Trade-unions without and labor problems within are leading business men to seek a solution of their difficulties in the creation of a new department, headed by an employment manager or industrial counselor. The duties of such an officer are not as yet fully differentiated, but the goal that the employment relations are forcing into sight involves an industrial audit, conducted after the same method as that employed by accountants and engineers. The report of such an audit might contain the following statement of conditions, which will show

how far afield a lawyer might be in attempting to give advice:

(a) Analysis of fundamental industrial conditions.

1. Sources of labor supply.
2. Attitude of the management toward labor-unions and other associations.
3. Relation of the management to labor laws and court decisions (state and federal).
4. Public policies ("safety first" and the like).

(b) Analysis of employment conditions within the organization.

1. Description of jobs.
2. Selection and training of employees.
3. Wage system; method of payment—rates, amounts, etc.
4. Labor turnover.
5. Safety; sanitation, health, education, etc.

This field of what may be termed "industrial auditing" is still young, and its technic is not fully developed. The system is being tried out, however, and its possibilities are being proved by the test of practice. The preparation of such an audit would bring before a concern such businesslike questions as these: What are the fruitful sources of labor supply for the factory and the office? Except for the grades

of labor at the bottom, does the firm find its best source of supply within itself? Are the channels *up, out* and *in* kept open and carefully guarded? Is the educational system of the concern a basic factor in the methods of discipline? Are the wastes due to the selection of wrong persons minimized? Are useful suggestions freely offered by all concerned? Is the spirit of cooperation predominant, and is it firmly based upon the knowledge of what the business as a whole stands for?

These questions show the newer conceptions of the problem of labor control as contrasted with the earlier ideas of rewards and penalties based entirely upon the bauble theory of old-time administrators.

9. *Attitude toward employes.*—The attitude of many managers toward the selection and the discharge of employes is one of extreme indifference. Nothing illustrates this better than the manner in which testimonials are frequently written. A discharged drunkard oftentimes receives a testimonial that he has been found sober and industrious while the discharged crook will be praised for honesty and industry.

The newer attitude toward employes is evidenced in the interview, the application blank, the physical examination and the psychological tests which are being used to prove or disprove the validity of the testimonials submitted by prospective employes.

Competition is forcing business men to seek new economies. All plants are approaching similar levels of competition in equipment, machinery methods,

purchasing skill, price of raw materials and promptness in deliveries. In the near future, the varying grades of competitive success will be decided by the savings made thru the elimination of the wastes due to a high labor turnover and by the removal of those maladjustments that prevent a business organization from taking effective root in modern economic conditions.

10. *Causes of the turnover.*—The reasons why men leave jobs are, of course, as numerous as the chances for the misunderstandings, mismanagement and maladjustments that grow out of men's relations to one another and to their work. Investigations of the turnover of factory labor show the following factors which figure in it: Abundance or lack of work, fluctuations in the amount of work, rates of wages, character of working conditions, efficiency of management, relations between the men and the management, workmen's opportunities to secure better work, and their qualifications or lack of qualifications for that work. Two cases that are given as typical indicate the nature of the questions with which modern management must deal in solving the problem of turnover wastes.

Case I. In a lumber mill, in 1915, 49 men were discharged in 8 months for:

Incompetency	20
Insubordination	13
Drink	12
Poor health.....	4

Case II. In 3 metal-trades establishments, during 1913, 402 men were discharged for:

Incompetency	133
Unsteadiness and loafing.	36
Disobedience	30
Slowness, sleepiness.....	16
Drink	14
Miscellaneous	11
No reason given.....	162

The significant thing about these tables is the large number of discharges due to causes which in most cases could have been avoided by the exercise of greater care in the selection of the men, while undoubtedly many employes might have been saved to the firms if they had been given a chance in other departments instead of being summarily dismissed when found unsatisfactory.

11. *Reduction of labor turnover.*—Frequency of labor turnover is a source not only of vexation, but also of expense. Anything which can be done to reduce the turnover avoids expense and makes the factory run more smoothly. The establishment of an employment department in some cases produces these very satisfactory results.

An instance of what has been achieved by one company in the direction of reducing labor turnover thru the careful selection and follow-up of employes, is shown by the following statement:

<i>Year</i>	<i>Labor turnover</i>
1911	68%
1912	61%
1913	52%
1914	37%
1915	28%

This company employs 2,300 persons and estimates that it costs, on the average, \$50 to replace a proficient hand. In the second year of the new system there were savings of about \$25,000 over the year preceding its installation.¹

12. *Labor a relationship*.—Labor as one of the important relationships in the structure of a business organization, is one of the newer conceptions determining the solution of employment problems. Labor exists only in the act by which it is sold, and it cannot exist unless it is given access to capital. It is not a commodity in the sense that the workman can store up stocks of it to be used as a basis on which to bargain for work.

If a business organization were an association where the three prime factors of labor, capital and management which are engaged in production, shared alike in the profit and loss and in the government, the nature of employment and the consequent wage and labor problems would be entirely changed. But the business unit has been developed along other lines. Labor does not bear the risk, nor is it entitled by law to a

¹ Report of Committee on Employment Plans for National Association of Corporation Schools, 1916.

share in the accumulated stock, the right of business initiative, the management and the credit of the concern. These belong solely to those who supply the capital, while labor discounts its risks for a fixed periodical wage. Because of the exclusion of this essential factor of production from the management, and because labor cannot be accumulated as a "reserve," the workman has attempted to protect his interests and to strengthen his bargaining powers by the formation of trade-unions.

13. *Wage relationship*.—The tendency in the payment of wages is at present to adjust them more closely to the work performed. This is a primary purpose of piecework. The reduction of the term of service in time-work from a yearly, monthly or daily basis to an hourly basis points in the same direction. One result of this method of measuring work against pay is that the laborer is secure in his income only from hour to hour, while the shortest lay-off means a loss of income. This tendency in the payment of wages has made the factory laborer feel that he is not a fixed part of the organization, and that his wages, both in amount and in regularity, depend upon the bargaining power of his union. It is not surprising that his loyalty should be to the union rather than to his employer.

Here is the weakness of modern administration. Without loyalty there can be little cooperation, and without cooperation there can be no great advance in the science of administration, under our present com-

plex system of industry. The loyalty which the worker should give to the business is given to the workingman's union. If the union is strong, the worker can exercise thru it some influence upon the conduct of his employer's business, even tho he is denied any share in the control of the latter. The growing influence of the labor-union upon management policies is second to none in the realm of business administration. With the increasing influence over private enterprise that the working class is gaining thru unionism, the laborer is demanding a voice in the regulation of questions of administrative detail within the firm. The relations that the unions involve, include not only the fixings of standards of pay, but also questions of the output of the individual worker, the conditions and the regularity of employment, the proportion of apprentices to the number of adult workmen and the methods of procedure on the occasion of any disagreement. All this means that the manager must share the administration of his business with an outside body in regard to many questions of internal organization.

14. *Democracy and industrial freedom.*—Every step in the solution of problems of employment relationship must tend toward democracy in industry. The manager who does not get this point of view is not taking advantage of the natural channels of public opinion in his search for greater business efficiency. Professor Carver of Harvard University says:

Two things and two things only are essential to real democracy; the first is an open road to talent; that is to say

that every man shall have an opportunity to rise to positions of power and responsibility in proportion to his ability, regardless of birth, privilege, caste or other social barriers. The son of a peasant may become the ruler in government or the employer in business, by the sheer force of his own merit, if he happens to possess merit. The second essential of pure democracy is that they who are in positions of power and responsibility shall be made sensitive to the needs and desires and the interests of those over whom they exercise power and responsibility.

The opportunity to "make good" is the reward that modern methods emphasize as to be preferred to the bauble rewards of the older school. Such a policy means constant watchfulness on the part of managers but keeping the road open to talent can be made a practical working principle.

REVIEW

Sum up the arguments pro and con on the subject of control of the employe thru the giving of titles and prizes.

Why should a manager base his methods of labor-control on the strong elements of human nature rather than on the weak ones?

Explain the distinction between the expressions, "a job" and "my job."

What is meant by an industrial audit, and what is the nature of the investigation that such an audit would involve?

What is the relation of the trade-union to the workingman, and how far can the business administrator give the workingman what the trade-union gives him?

What are the purpose and function of the employment department?

CHAPTER VI

PRINCIPLES OF BUSINESS MANAGEMENT

1. *Administration at close range.*—We are now ready to consider the subject of administration at closer range. Administration, as we have interpreted it, applies to the big policies, and is therefore more inclusive than the word "management." We shall be concerned henceforth with the control of these policies thru systems and offices, which may be termed "management." As here used the term applies to the direction and control of the forces which produce results in factory or office operations.

2. *Cardinal elements of management.*—Management implies three things—a force, a purpose or result to be accomplished, and a director of this force toward the desired end. With any one of these three things lacking in an activity, no such thing as management is possible.

In a baseball team, for example, the members represent the force to be managed; each player is a human dynamo. The winning of the game is the purpose, and the captain directs the general play to this end.

The use of the word "force" to indicate the body or machine employing force is significant in itself. We often speak of the "police force," the "working force,"

etc., when we mean the body of men which supplies the energy or force to be used in carrying out any project.

3. *Every principle implies a force.*—The most important thing about management, then, is that it deals with forces, i. e., energy. This fact alone raises business management into the realm of those subjects worthy of being treated scientifically. "Scientific management" would be meaningless jargon if forces were not involved. And it is well for the business man who has thousands of dollars invested in plants, offices, men, fixtures, etc., to realize this point at once. It will enable him to discriminate between the real efficiency engineer and the fake systematizer. The latter knows nothing of *forces*. He knows only of *forms*. The man who knows and realizes the nature of the forces working in a modern factory or mercantile establishment, is conservative. He realizes the consequences of getting in the way of these forces. A fool will try to stop a flywheel with a piece of cardboard. Yet unfortunately, simply by reason of his assurance born of ignorance, a fool may gain the ear of an executive. But the manager who thinks of his business in terms of the forces which he is guiding can soon put to rout the "business doctors."

4. *Nature of business forces.*—The promotion of a business enterprise is at bottom nothing more or less than an attempt to bring the forces of capital, labor and land together in such proportions and with such effectiveness that the highest profits will result from their combined efforts. There is no common business

name for the manager of an enterprise in the earliest or formative period of an undertaking. The economist calls such a man an enterpriser. If the title of "promoter" had not become so closely associated with the raising of capital or the effecting of combinations of capital to the almost total exclusion of the other two forces of business, this name would more fully express the function of such a person than any other word. But whatever his name, a man of this sort is a manager *par excellence*. His plans involve the primary union of the three business forces, capital, labor and land. Poor management at this point means hampered production, poor distribution or lean markets after the business is started.

Let the reader adjust himself at once to the point of view that management is interested in forces and not alone in things, methods and forms. If the idea seems abstract that management begins before the money is raised or the factory started, the notion can be given concreteness by thinking of the numerous failures of managers of production whose efforts and plans were useless because some incompetent enterpriser had started the business with too little regard for his labor supply. Or it might be well to look into the history of many managers of distribution, men who were doomed to failure from the start because some enterpriser had overlooked the important place which location holds in relation to freight rates or delivery advantages. Or, again, the reader may find numberless examples of good sales managers whose efforts

were handicapped for years because they could not develop their markets, owing to a lack of sufficient working capital.

Management, then, deals with the three sources of force or energy—capital, labor and nature. The management should never lose sight of their important influence. A strike which involves trouble with the labor force may mean many hours of anxiety for the manager, but the labor loss may be as nothing compared with the capital losses in interest, depreciation and market disorganization incurred during the shut-down.

5. *Manager must direct forces.*—The complexity and extent of the workings of a modern factory are forcing the question of management upon the attention of both stockholders and the public. The stockholders are interested in their profits. The consuming public is concerned about the high cost of products. Both are beginning to believe that their interests could be better served if the managers of production were specialists in management rather than as is too often the case—composites of abilities ranging from the requisites of a good office boy to the accomplishments of a mechanical expert.

A manager must direct forces. He cannot be tied to the details of an office, of a department or of an organization. His special work is cut out for him by the forces which he handles and the object which he must attain in their direction or management.

The mechanical engineer, the electrical engineer, the locomotive engineer, etc., have their own special provinces. Each is a specialist in the control of his particular form of power. Yet it has often been expected of managers of production that they not only be technical experts in various branches of an industry, but that they be expert handlers of men and judges of business methods as well.

The discussions and investigations of big business operations during the past few years have so focused attention upon the manager that we are able to see his true relation to the organization in a better light than ever before.

A chart, prepared by an auditing concern and reproduced on page 60, shows in a very simple way the relationship of the two chief forces with which the manager must deal.

It will be here observed that the capital, land and labor forces have taken the form of plant and equipment, materials, supplies and men. The manager, therefore, has jurisdiction over these things and has charge also of the inspection of product and purchases. The two types of physical energy which are most evident in production, and which the manager must control, are those produced by fuel in conjunction with a machine, and those which come from food when converted into the muscle and brains of men. When the full importance of these factors in management is realized, it becomes evident at once how

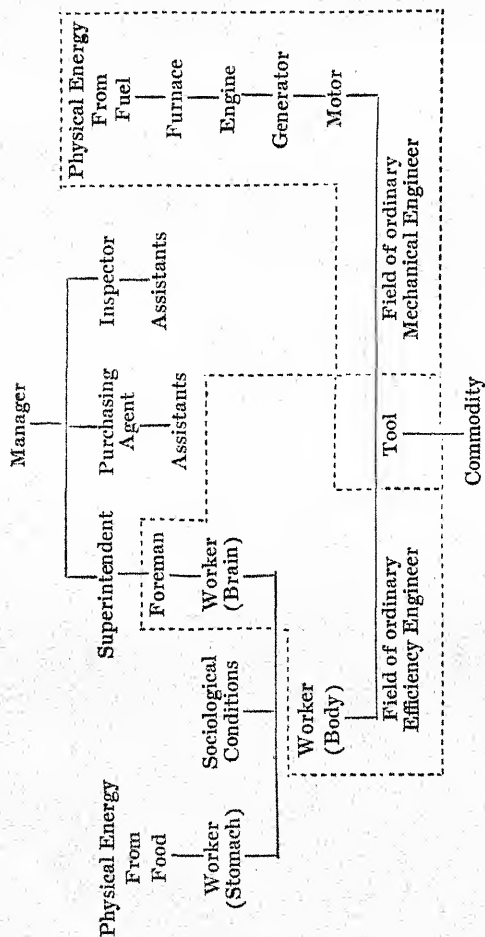


FIGURE 1.—CONTROL OF BUSINESS ENERGY.

futile are systems and schemes of control which provide only records of results, and ignore the forces which produce results.

6. *Human engineering*.—It has been supposed

until very recently that engineering has to do solely with the intelligent development and control of that energy which depends upon fuel and the machine. Accordingly, the mechanical engineer early became a recognized aid in the management of a plant and factory, and now that business men are beginning to analyze their productive processes, the profession of engineering has been extended to include the development and control of that energy which displays itself thru the minds and bodies of men.

A study of Figure 1 shows the main lines of activity which these two forms of physical force follow. The physical energy coming from the food which a man eats shows itself in either bodily or mental activities on the part of the worker. In the factory, then, we may divide the workers into brain laborers and body laborers, and so throw into bold relief at once the basic problems of management. These are the prime factors which lie at the bottom of all permanent productive efficiency. The managers must find the best way to develop this human power and conserve its energy. Looked at in this light, it is not a matter of indifference to the management what the foremen, the laborers and others eat and drink outside of factory hours. Nor is it compatible with the principles of business management to ignore the sociological conditions which surround the workers at home and in the shop. Anything which dissipates the energy of the employe is a handicap to the productive efficiency of the factory. Welfare work, medical service, indus-

trial betterment are growing and spreading among the world's great industries. This movement is taking place simply because it is good business policy. If welfare work succeeds, it does so because it develops and conserves the human working force. It pays for itself in productive efficiency and not merely in its advertising possibilities.

7. *Basic principle in management.*—Little need be said about the power which manifests itself thru the aid of machines. This force in production is very evident and its utilization has been the point of attack for a hundred years or more. In fact, so much attention was given to this factor that the managers of great enterprises overlooked nearly all the other elements in production. To get a new piece of equipment, a machine, a filing cabinet, an adding machine, seemed to be the climax of many a manager's ambition. Concentration upon this single side of the proposition has brought its penalties as well as its rewards. Managers fixed their eyes upon the size of their output. Bulk, production on a large scale, tonnage became the great words in managerial circles. To secure these results the machine was developed to the highest point. Mechanical invention was the only thing considered, and the mechanical engineer became the most important member of the staff of managerial experts.

But finally the machines became so plentiful, the factories covered so much space, the output grew so large, the employes numbered so many thousands, that the energy which was developed and directed by

means of the mechanical equipment began to be lost and wasted. The old standards of achievement could not be maintained and the management began to ask itself the reason. The inquiry led to the discovery of the basic principle in management, which deals with the conservation of energy and the correlation of the forces of production. When this point was reached many problems arose which had not up to that time intruded themselves. For example, the question of fuel supply was no longer a question of weight but of heating power. The belting problem was no longer a question simply of price per foot, but of lost power thru inattention to the proper belt tensions, etc. Thus we might run thru the whole list of problems of management and find that in their last analysis they all resolve themselves into terms of power, force or energy.

8. *Purpose of management is profit.*—It is well, when so much is being said about the methods of gaining productive efficiency, to draw attention to the fact that the ultimate purpose of enterprise is profits. A saving of energy formerly lost, or the institution of a frictionless organization, may have other purposes than maintaining or increasing the profits; but unless these things bear upon this element somewhere in the course of the firm's operations, they should be counted up to the concern's philanthropies or advertising and not to its productive management. The manager or efficiency engineer who is unable to organize or reorganize a system of management without sacrificing

permanent profits has not the faintest conception of the nature of his work. Such a person is generally trying to "instal a system." It should be borne in mind, however, that a thorogoining plan of management may, and for that matter generally does, involve an outlay of money which may not show immediate returns. A suitable foundation for a building may not show its advantages over a flimsy structure for several years; yet a wise business policy would not sacrifice the permanent profits for the sake of immediate savings.

9. *Immediate versus future profits.*—No one business policy has caused the wrecking of so many firms and the shattering of so many managerial reputations as that of paying dividends, regardless of the means or source of income. A manager must gain the profits by putting the materials and forces of production thru certain processes. The legitimate gains of his activity as manager show in a product of higher value. He starts, we will say, with a ton of iron ore, and after many smeltings and purifyings and temperings, thousands of fine steel springs are produced. So long as quality determines value, and value determines price, the manager's duty is to shape his methods toward meeting the conditions of that market the judgment of which passes upon the quality of all products. He therefore turns out steel springs of a quality that satisfies the particular demand for that product. His influence upon the profits will show in his maintaining the quality demanded by the customers, and in his

ability to effect economies in the use of the forces of production and in the handling of his productive organization.

But, having been urged to show immediate results, many managers have tried to short-circuit their forces of production. Instead of putting the capital which should have gone into materials, new machines, new roadbed, new cars, etc., into these investments of production—investments which would have brought profits in the future—some managers have short-cut the process and put the capital directly into the dividends. The “skinning” of many railroad properties and industrial plants by this short-circuit process was too common a few years ago. It is not unknown today, and it is a very alluring method for a young or inexperienced manager when a short-sighted directorate insists on “results.”

This practice of sacrificing the permanent profits for the immediate “showing” is not less fatal when applied to the business organization of a company than when used to “skin” the equipment. Poor routing of materials thru the shops, slack timekeeping, persistent soldiering, bungling storekeeping, etc., may mean a very economical organization for a certain period, but the effects of such disorganizing practices upon the output of a plant will prove in the end to be even more damaging than the mere skinning of the capital or equipment.

REVIEW

Distinguish between the functions of a “promoter” and those of a general manager of a factory.

66 FACTORY AND OFFICE ADMINISTRATION

Distinguish between the activities which fall within the province of the mechanical engineer and those that belong to the industrial engineer.

Analyze the statement, "The basic principle in management deals with the conservation of energy and the correlation of the forces of production."

A factory manager was able to show "good results" by keeping back new improvements, holding up needed repairs, etc. Criticize this policy.

CHAPTER VII

WHAT MANAGEMENT INVOLVES

1. *Difference between manager and engineer.*—Management, therefore, involves not only the forces of production, but careful considerations of the results to be obtained, i. e., the profits. It is the latter which distinguishes the man with managerial ability from the purely technical man. The mechanical engineer may be able to control and develop the productive forces in a plant. In fact, a specialist of this kind is absolutely necessary. But his point of view is narrowed to the activity of the machine and of the machine's tender. He is interested in supplying power and machines for getting out articles according to certain dimensions and specifications. The manager must be able not only to judge the mechanical necessity of this activity, but also to estimate its effect on the commercial end of the business. Commercial appraisal must supplement technical judgment. Many illustrations of this difference in abilities might be cited from the experience of shop men who have seen many a fine article, from the engineers' point of view, sent into the factory, only to be torn to pieces and ruthlessly changed by the manager who had to meet commercial conditions.

2. *Specialization complicates management.*—Specialization is both a result and a cause of technical improvements; therefore, we find the two developing side by side. So far as the modern industrial organization is concerned, it makes little difference whether we speak of it in terms of specialization or in terms of machinery. A study of any industry will soon show how complex its organization has become, thru the number of specialties into which every process is divided. Generally, each division requires a new machine or tool. If we compare the present organization of any industry with the organization of a similar industry of fifty years ago we discover that, altho the number of men necessary to produce a given quantity of product has greatly diminished, the quantity put out under one management has so increased that the number of employes has increased and the number of machines has multiplied accordingly.

The manager has been engulfed in a sea of industrial specialization. The correlation of all the special activities has overtaxed the abilities of managers for years—that is, where they have given this element of management the consideration it deserves, and have not simply stumbled along trying to meet every difficulty by adding a new machine—a method not unlike that of a tired man urging his flagging energies to renewed efforts by taking stimulants. They get him over the present difficulty, yet they leave him not only debilitated, but hindered by the drug itself which clogs his system.

3. *Specialization in management.*—Not many years ago it was the custom to defend the advantages of specialization against the virtues of all-round skill—the expert against the all-round man. But there is little argument today. The place of each is well understood. In technical work the economic superiority of the expert is too much in evidence to allow any argument. The “jack of all trades” has disappeared. The change makes for special dexterity and great saving in time and money. Preparatory expenses are greatly reduced and much time in changing from one job to another is saved. At the same time we have come to recognize that there is a distinct and very important place for the all-round man in executive work of the higher order.

Today there is a new form of specialization going on, which, being more difficult to represent in a concrete form, is not so easily understood or so readily accepted by the manager. We refer to the specialization that is taking place in the field of management itself. Instead of employing one foreman to look after a whole department some firms are breaking up the work into several parts and are putting specialists in charge of each. Thus there may be a gang boss, a speed boss and a disciplinarian where once there was only a foreman. As it is not easy to figure the results of management specialization in terms of a machine's output—a concrete thing which can be shaped and handled and measured—many executives are backward in recognizing the same economies here that

they have so eagerly exploited in the field of technical and mechanical specialization.

4. *Department specialization.*—Between the two extremes of specialization, that of the machine at one end and that of the management at the other, comes an intermediate type of specialization. This may be called departmental specialization, and often serves as a step to the more advanced form of specialized management. This intermediate type is illustrated in the Pierce-Arrow Motor Car Works. Here all lathes are divided into groups and subgroups. The main groups are put into departments by themselves and are there arranged into subgroups according to the size, class of work, etc. For instance, one section is known as the turret department and is divided into subgroups of automatic chucking machines, automatic screw machines, flat and hexagon turret lathes and hand screw machines. The larger turret lathes of the Gisholt type are not included in the department, but form separate groups. The hand and spur gear-cutting machines form separate groups. The milling machines are classified as vertical, horizontal, Lincoln type and hand groups. The drilling machines are divided into radial, heavy-duty, medium and sensitive groups. The grinders are grouped as internal, plain and surface. Specialized supervision is thus naturally induced to a limited degree, for an assistant foreman is put in charge of each subdivision of machines and is responsible to the foreman, who has direct charge of the departmental groups.

The necessity for this growing practice of departmental grouping is due to the great burden which extensive specialization in the agents of production has put upon the manager. Departmental grouping is an attempt to bring as many common factors as possible into one group for purposes of supervision. It provides a more efficient means of watching the wastes and coordinating the efforts of many individual and highly specialized machines. The experiment of the Pierce-Arrow Company shows a practical application of the economic principle that coordination is a necessary complement to specialization if the highest efficiency is to be obtained.

5. *Cooperation and specialization must always go together.*—Just as the forces of a business must be correlated, and the machine processes coordinated, so must the laboring force cooperate in order to let specialized employment and divisions of labor produce their full results. The enormous product turned out by the factories and transportation systems of today is possible because the machine has developed into a specialist of the highest type. Specialization does not stop, however, with the factory processes, the warehouse, the bank or the transportation system. The management of these various business activities is dividing its work more and more into specialties. One man no longer tries to do all the work of managing a factory, but calls to his aid superintendents, foremen and bosses.

Such is the predominant type at present but it is

rapidly becoming modified. The machines, the men, the departments, the responsibilities of a large factory are so numerous that further specialization must go on if this century is to keep up with the last in the production of goods.

6. *Scientific methods of investigation.*—Scientific knowledge rests upon one great underlying principle—the conservation of energy and the correlation of forces. There are, however, two ways in which a subject may be studied. These may be called the “speculative” method and the “practical” method. The first has been largely instrumental in the development of the sciences of astronomy and biology, and the second has been chiefly employed for investigations in chemistry. Sciences differ among themselves in the extent to which one or the other of these methods is used, and it is essential that a new science adopt the method most suitable for its development. So far as management is concerned, both methods are applicable to a certain degree, but the practical method, in which experiment is the basis of drawing scientific conclusions, is the one which must predominate.

Only a few deductions can be drawn in the science of management. But these few are most important, since they serve as guides for the experiments in, and analysis of, factory, shop and office conditions. They look to the avoidance of waste and the gaining of increased power thru a thoro knowledge of men, machines and conditions. If investigators of management problems would keep this one idea clearly in

mind, they would then at least be in the right attitude to begin their study. With this goal in view, the investigator can follow the practical method without confusing his principles with the mechanism. Such an investigator will hold the factory or shop in proper perspective and will not feel bound by traditions and prejudices. He studies the departments as a whole and compares them with those of other plants as he knows them. This method enables him to analyze the proposition into units which permit of numberless experimental recombinations.

All this takes time and patience, for superficiality has no place in any science. Mr. F. W. Taylor, for instance, to achieve one result, performed 50,000 experiments, all of which were recorded, studied and classified; they involved an outlay of material amounting to 800,000 pounds of steel and an expenditure of \$200,000. Similar care and attention must also be given where the data to be collected pertain to men and not to material. The laws of fatigue and rest are even more complex than the laws of materials. It is not till these laws have been discovered that standards of production can be established and methods set forth for their accomplishment.

Having the general proposition clearly in mind, the management investigator can go after his facts. Observation and experiment will be required to enable him to select the facts and, from conclusions drawn from them, to formulate those laws by which he can select his machines, material and men. Some laws

will become standards by which the workingmen in any particular department may be scientifically selected. The men who are physically or temperamentally unfit to perform the duties in a particular department may be taken out and fitted into some other place more suited to their particular abilities. Such a redistribution of men results in a total increase of efficiency without drawing forth more labor energy from men and machines. The results will show not only that a scientific method has been used, but that a scientific object has been obtained.

7. *Continual study and progress.*—The first practical rule in the application of this scientific method of adapting the instrument to purpose, demands not only a redistribution of responsibilities but the establishment of intimate cooperation between managers and men. This may be called the rule of sympathetic cooperation, in which there is "mutual recognition of the possibility of mutual helpfulness." An example of this practice is seen in those shops where the chief distribution of functions consists of dividing the purely mechanical and muscular operations from those requiring brain and effort, and then selecting men who are particularly fitted for each kind of work. This division and redistribution of the functions necessitates a greater degree of planned cooperation between the two groups than was essential under the old style of management. Under the old system the workman was left to determine the method of doing his work as well as to do it. Under the system

where the function of planning is separated from the performance, the method is given into the hands of an expert body of planners and the workmen are left free to apply all their energy to the one thing—the doing of the work.

Present-day management, however, does not stop with experiments alone. It requires that the facts, having once been obtained, should be used for the continual advancement of the organization. The first rule for the practical administration of the laws and principles which have been deduced should be the selection of proper instructors to teach the men upon whom the production of the plant depends. Under this rule, a workman, once selected and assigned to a duty to which he is especially adapted, is kept at his highest point of efficiency by being continually helped and taught how best to do his work. The factory thus ceases to be a “mill” and becomes a school instead.

A law is limited by the circumstances which condition it. Before any specific devices are discussed by which the direction of a business enterprise may be changed from a “hit and miss” sort of management to a system of carefully studied control and direction, it may be well to throw out the following caution. Altho a law, once formulated, is fixed by the conditions which gave rise to it, there is no assurance that the conditions will not change. In fact, conditions are ever shifting and, as a consequence, new observations and new experiments will result in the derivation of new laws. No manager should assume that any con-

clusion he may reach is final. A rule of action which may guide the organization today to higher planes of efficiency may later be rendered obsolete by a new set of conditions and higher standards of accomplishment. The manager who approaches his subject in the spirit of a scientist never stops because a cost has been reduced. Nothing is final with him. He is ever on the lookout for the possibility of further reductions and the discovery of new and important laws by which these reductions may be made.

8. *What the science of management involves.*—A science of management involves a natural force, an inductive method of study, and a distribution and grouping of activities according to functions.

One of the great difficulties in getting business men to see that management is anything more than just "common sense," is their disinclination to listen to anything which smacks of theory or principles. They assume that common sense deals with concrete things while theory deals with abstractions. The truth is that common sense is not dissociated from theory. The thing which people call common sense is simply the working out of a theory or principle thru concrete things. When the phenomena are familiar and when the causes and effects are in harmony with ordinary experience, they are spoken of as simply common sense. The trouble arises when a man mistakes the illustration of a fact or principle for the principle itself, and thinks he has dodged all responsibility for thoroness of investigation and care-

fulness in recording and studying data, by calling the whole thing simply a question of common sense. To the janitor the putting of salt on an icy sidewalk is simply a question of common sense; to the chemist it is a question of chemical affinity. To the ordinary "boss" the following example taken from Mr. F. W. Taylor's experience will appeal only as a common-sense thing to do; to the manager looking for truths by which he may guide his own endeavors, there will appear the great problem of the saving of labor power, the inductive principle of investigation and a never-ceasing struggle to attain new standards of efficiency—there being no assumption of finality in the derivation of laws.

Mr. Taylor was looking for the law controlling the efficiency of shoveling. Accordingly, he first selected the type of man who was best adapted to the work. He did not, as he says, take a trotting horse as his standard to find out what a first-class draft horse should do in hauling coal. So when he wanted to study the science of shoveling he selected two men and spoke as follows:

You are good shovelers; we want you to work squarely. We are going to ask you to do a lot of fool things, and we are going to pay you double wages while this investigation is going on. It will probably last two or three months. This man will be over you all day long with a stop-watch. He will time you; he will count the shovel-loads and tell you what to do. He does not want you to hurry; just go at your ordinary pace. But if either of you fellows tries to soldier on us, that will be the end of it; we will find you out as sure as you

are born, and we will fire you out of this place. All we want is a square day's work; no soldiering. If you don't want to take that job, don't, but if you do we are very glad to pay you double wages while you are doing it.

These men took the job and did a fair day's work thruout the period of investigation. Mr. Taylor continues:

We began by taking the maximum load on the shovel and counting the shovelfuls all day long and weighing the tonnage at the end of the day. I think it was about thirty-eight pounds to the shovel. We found how much those men could do when they were shoveling at thirty-eight pounds to the shovel on an average, and then we got shorter shovels, holding about thirty-four pounds, and measured the tonnage per day, and it was greater than when they were using the thirty-eight pound shovel. They shoveled more with the thirty-four pound shovel-loads than with the thirty-eight pound shovel-loads. Again we reduced the load to thirty pounds and they did a still greater tonnage; again, to twenty-eight pounds, and another increase; and the load kept on increasing as we diminished the shovel-load until we reached about twenty-one pounds, where the man did his biggest day's work. With twenty pounds, with eighteen pounds, with seventeen, and with fourteen, they did again a smaller day's work. Starting with a thirty-eight pound shovel, they went higher and higher until the biggest day's work was done with a twenty-one pound shovel; but when they got the lighter shovel the load went down as the shovel-load diminished.

The conclusion reached from this long experiment was that the highest efficiency in shoveling depends upon supplying the workingmen with a shovel which holds twenty-one pounds, no matter what the material may be.

9. *Effect of a new standard.*—But a standard established in one department meant a change of conditions in other departments. The principle of the distribution of functions applies to departments as well as to men, and upon a correct balancing of them depends the success of a management which would avoid waste thru a correct correlation of its productive forces. This principle is well illustrated in the final outcome of the experiments with the shovelers. First the management had to build a shovel-room for the common laborers. Up to this time the men had owned their own shovels, but now all this was changed, for it was found necessary to equip the shovel-room with eight or ten different types. One shovel, for instance, would be suitable for rice coal; another for a very heavy ore, etc., but each would carry just a twenty-one pound load.

The establishment of a shovel-room was a simple thing in itself, but it meant organization where before there had been none. A good shovel is of little use unless the right laborer has it at the right place, and in a yard two miles long and half a mile wide, and employing six hundred men doing all kinds of miscellaneous work, the arranging of a working schedule is no small task. This meant more organization and a redistribution of managerial functions from the foreman's point of view. Instead of having the old-fashioned foreman, who walked around with his men and told them what to do, a large building was erected for a labor office and three highly trained men with their assistants,

planned the work of the shovelers at least one day ahead of the work.

10. *Furnishing the men with a teacher.*—The final element in business management also is illustrated by the methods described in the experiment which has been described. The teaching element is no new thing in management. It has always been there, but generally it has been so confused with other functions that it has been lost sight of in these days of big and complex business operations. Every boss is supposed to be an instructor, but he uses his authority more often than his knowledge of the particular job to keep the laborer to his pace.

In some of the more recent attempts to discover the principles of management, the function of instruction has been again emphasized. This, also, is seen in Mr. Taylor's experiments with the shovelers. Having provided a physical organization for handling his six hundred or more men, he made out a time-table showing just how long it took the men to do each kind of work. Then it devolved upon the management to inform the men each day just what they had done the day before, and just what they were to do that day.

The teacher would stand beside the man as a friend and show him how to earn his premium. Or if he found men too light for the work the teacher would recommend that the men be transferred to a job better suited to their strength. Kindly and intimate personal study of the workingman is the surest way to find the work best suited for each man. The instruc-

tor coordinates the work of the planning room with the work of the laborer and in that way facilitates the flow of productive force in the business organization.

REVIEW

How should an investigator of factory conditions go about his work if he would be considered as doing his work scientifically?

What effect has the growing tendency toward specialization had upon the problem of management?

How can the deductive and inductive methods of scientific investigation be adapted to factory and office management?

How can the methods of the teacher be introduced naturally into factory and office management?

CHAPTER VIII

ORGANIZATION OF ADMINISTRATION

1. *Few principles but many methods.*—The principles of management hold true in every kind and branch of business. It makes no difference whether the business unit is a billion-dollar corporation or a foreman's department where pig-iron is handled. But the methods of applying these principles are as varied as the types of business themselves. There is a particular method most suitable for each business and each department. Businesses, like people, have personal characteristics; no two are exactly alike. If every person were to dress in the most appropriate style, it would be necessary to put him in the hands of an expert and let the latter study all the points of harmony so as to dress the customer accordingly. In such a case, ready-made clothing would disappear and valets and custom tailors would increase in number. Such great economies have been effected, however, by the adoption of certain standardized units, such as hat, coat and trousers, that a tailor or a clothing house that tried to eliminate or seriously modify these clothes, would soon go out of business.

Likewise, economic society has adopted certain business units for purposes of management. These units of management correspond roughly with a natural di-

vision of the anatomy of business enterprises. The legal corporation and the commercial organization are units of management because the anatomy of a business is naturally divided into a head for ownership and a body for production. A style of hat which obscured the eyesight would sacrifice efficiency to vanity. A method of corporate management which neglected the stockholders would sacrifice an ownership function for a selfish reason worse than vanity. Now what we wish to show by the comparison is this: Just as there are many styles of hats, so are there many methods of management; and just as the best hat is determined by its fitness to serve the purpose of a hat, so is that method of management best which carries out most efficiently the functions of the department which it serves. The basic functions of a hat are protection and adornment; the prime functions of management are control and direction. Methods, like styles, must conform to the purposes for which they were created.

2. *Economic units.*—The economic unit, starting with the family, at length grew to include the town and finally embraced the nation. But as nations develop and extend their territorial control, the lines marking out the boundaries of the present economic units become more and more arbitrary, and only tend to confuse, instead of to help, clear thinking on economic subjects. This economic fiction is being maintained thru the necessities of political policies rather than by the demands of economic science.

The best units in a science of economics are not de-

terminated by their size or weight, etc., but by the function which is performed. Thus, we find that the science of economics is divided into the four fundamental branches of production, distribution, exchange and consumption. Each of these, in turn, is divided into units which are classified according to the function which each performs; thus, production is considered from the points of view of the three units of capital, labor and land.¹ Now each of these units is again divided into other units; hence, capital is spoken of as fixed or circulating, according to the way it performs its function—and thus we may go on subdividing and resubdividing as long as a single shadow of difference in performance of function remains.

It was by such rigid analysis and classification that economics was reduced to a science of business relations. It is only when the basic units have been determined that true measurement or judgments can be made between the respective demands of labor and capital. We must know the function of each before we can determine the rights of each from the social point of view.

3. *Industrial units.*—In the broad field of economic activity we distinguish the different industries. Here again we search for the unit of classification based on the function which each industry performs, and we find manufacturing industries, transportation systems, banking or exchange houses, etc. Each is an in-

¹ The facts here stated in general terms have been more fully set forth in the Modern Business Text on "Economics of Business."

dustry, in that it uses the elements of land, labor and capital to effect different objects. These functions are sufficiently described by the names themselves.

4. *Distinctions between economics, industry and business.*—Business, in the narrowest interpretation of the word, is made up of activities designed to effect a specific purpose within the field of each industry; manufacturing is a broader term than plant; transportation than railroading; exchange than banking. Therefore, if we are to get a clear understanding of a business we must discover the basic functions which give character to it, or which, as we commonly say, determine the nature of an enterprise. This is a somewhat difficult matter under the present confused conditions of thought concerning economics, industry and business. But, briefly, the differences are these: Economics treats of land, labor and capital in their relation to human wants; the social point of view is emphasized. In industry these three factors become parts of systems or processes by which society is furnished with economic goods. In business these elements are used for the purpose of producing revenue or dividends.

Thus we see that in economics the point of view is social. In industry it is partly social and partly private. In business the social point of view is completely submerged, and that of private interest predominates. These three points of view are clearly seen in the distinguishing phrases of each division. In economics they are utility, value or price; in industry

they are mass production, transportation in bulk, or syndicating; in business they are corporate control, centralization and money profits.

By keeping these three points of view in mind it is possible to see more clearly the great political and business problems of the nation, in so far as they have an economic basis. The railroad problem, the labor agitation, the tariff question, etc., all lie largely in the field of industrial organization; and the chief point at issue is to determine where society's rights begin and private privileges end. Society, for instance, is interested in having the manufacturers of the nation turn out a maximum of goods. The business man is not anxious primarily about the quantity of commodities made, but about the amount of money received for them.

5. *Managerial or business units.*—From the management point of view, the corporation is a form of specialization which puts the function of ownership and policy control into the hands of a management different from that which directs the productive operations of a business unit. The business unit became so large and complex that it had to be subdivided into smaller units for purposes of management. The corporate organization, therefore, forms one managerial unit, made up of stockholders, directors, committees and officers, for the purpose of directing the financial policy of the business. The other division which it has been found necessary to organize into a managerial unit is the operative or production end of the

business. The latter has come to be further specialized into what may be called a staff organization and a line organization.

These management units and their relationship to the general management can best be shown in the form of a diagram, as follows:

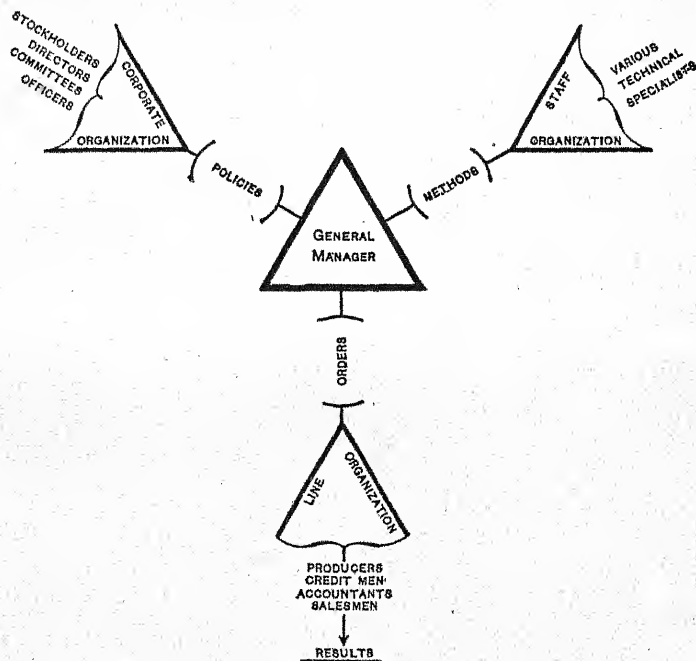


FIGURE 2.—CORPORATE, STAFF AND LINE ORGANIZATION.

An analysis of this chart will show that: (1) the corporate unit by virtue of its ownership reserves for itself the right of determining what shall be done by the general manager; (2) the staff organization unit

has become a necessary part of every large business, for the general manager cannot know *how* everything can be done in the best way; (3) the line organization gets its orders directly from the general manager, who is advised by the corporation and staff experts. Altho the results of the management issue directly from the line organization, yet the importance of the other units is not to be minimized. The corporate management is controlled by a body of specialists who devote their time to the consideration of financial and commercial policies; and the staff technical experts concentrate their efforts upon the planning of methods by which the purpose of the owners may be carried out thru the line organization—the men who obey orders and achieve results.

One important thing which should not be overlooked is the central position occupied by the general manager. It has been pointed out how closely specialization must be followed by a more comprehensive organization for the purpose of developing cooperation. With the specialization attendant upon the development of the corporate and operative units of management, there grew up an overwhelming demand for a coordinating managerial element in the business unit. The general manager is being forced more and more to assume this very heavy responsibility. It is his function to correlate the policies of the corporate advisers with the methods of the technical experts, and then to harmonize both of these with his

means of production as they are found in the line organization.

The details of management are therefore being forced upon three suborganizations which, until very recently, have been given little consideration from the point of view of management. As the pressure increases, the necessity of further specialization within each unit becomes greater. Thus we see new points forming, thru which managerial methods and policies are developed or directed.

While the complete treatment of corporations and their organization is given elsewhere in the Modern Business Series, a brief statement of their organization for management purposes is outlined here.

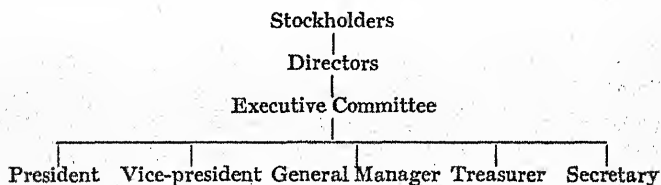


FIGURE 3.—ANALYSIS OF CORPORATE ORGANIZATION.

Corporate management begins with the stockholders, who own the business and consequently have initiatory powers. It ends with the executive officer, who, like the other officers and the committees, derives his authority from the board of directors, whose members, in turn, look to the stockholders. The president or vice-president presides at all meetings of the corporate organization. The treasurer is custodian

of the funds, which he disburses on receipt of the proper requisitions. The secretary takes care of all corporate correspondence and keeps the corporate records and the seal. The general manager, who is chosen by the executive committee, acts as the medium of contact for the corporate, staff and line organizations. The corporate officers may or may not be members of the staff or line organizations.

6. *Manager's cabinet.*—The operation of a plant, whether industrial or commercial, calls for the exercise of judgment upon many technical matters; accordingly, it has been found necessary to aid the general manager by means of an industrial cabinet made up of experts. For many years the manager, who was also a skilled mechanic, was able to conduct the operations of production with marked success. This was due to the importance of the part which mechanical equipment played in our industrial operations. But at length other factors in the making of goods became prominent. Chemistry became as important as mechanics. Now it is being realized that the organization of the factory, commercial house, bank, etc., must be given special attention. If the size of any firm's business is commensurate with the average American enterprise, few men would consider themselves capable of exercising the best judgment on all these different specialties. Accordingly, the management has been strengthened by bringing in experts in various lines.

7. *Progress due to expert knowledge.*—The history

of the industrial development of the various nations shows that the country which has led the world at any particular period has been one which developed first and most efficiently some one special activity as an aid to the management. England was first in the field with the use of power machinery. She became the "work shop of the world." America adopted much of the English technic but she leaped to the front industrially largely because of her corporate organization for controlling large capital forces and concentrating them in the exploitation of her natural resources. Recently the position of both England and the United States has been threatened by the industrial technic of Germany. She has brought industrial chemistry to her aid in the international strife for commercial supremacy.

The field of specialization which is still open for development, is organization. Few factories, railroads or banking institutions have placed among their technical experts a special department for furnishing advice to the general manager on productive efficiency. Judging by the widespread interest that is being displayed at present, however, it does not seem likely that American business men will permit this important function, management, to go undeveloped. Machinery, chemistry and corporate organization have all reduced costs. The extension of the organization principle to the fields of production, transportation, selling, etc., will have a like effect. Many men believe that the addition of an organization ex-

pert to the cabinet of the general manager is imperative.

8. *Analysis of staff and line organization.*—Next to the corporate organization stand the staff and line organizations as units in management. The following chart (Fig. 4) shows the position of various ex-

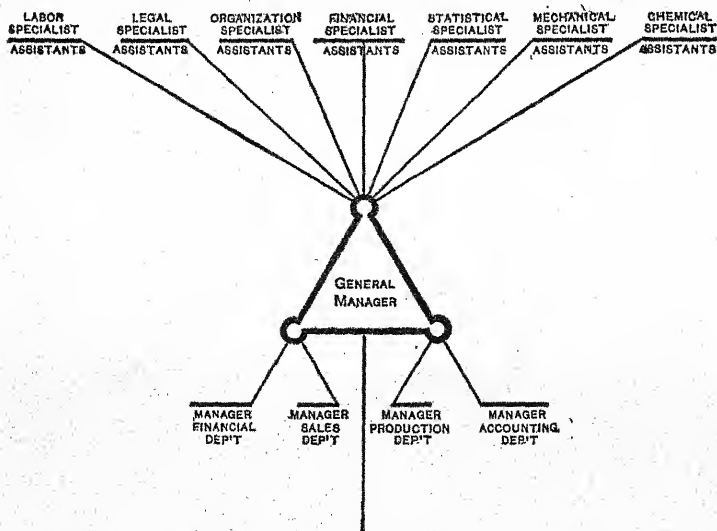


FIGURE 4.—STAFF AND LINE ORGANIZATION.

perts and their relation to that of the general manager; and also how these numerous activities may be further subdivided into smaller units for purposes of more specialized administration.

The various specialists belonging to the staff organization may be permanently or temporarily retained. In either case their position holds such a relationship to the manager's that they are not gen-

erally considered employees. The feeling is gradually growing that these men should hold the same relationship to the general manager that a lawyer holds to his client. The lawyer looks into the details of each case and reports to the client. The latter accepts his lawyer's advice or rejects it, as he thinks best. By referring the investigation and solution of the details to competent specialists, the manager is left free to assimilate their plans properly and to correlate the activities which follow from their advice.

When we come to the line experts, the men who are to carry out the orders of the general manager, we are on familiar ground. These departments have been closely connected with the management for many years. As the duties of the general manager have grown it has become necessary to depend more and more upon the managers of departments to look after the details. Some confusion has arisen as a result of this dependence upon the departmental managers. The latter in many cases have absorbed the functions of the staff specialists. They not only have become the executors of the work but also act as special advisers in the planning. If, however, the functions of their departments are kept clearly in mind, it will be seen that their activities should be confined to the carrying out of orders given them by the general manager. This division of function may not always be necessary or possible in small plants, but the consideration of management from the point of view of the units for carrying out the functions of manage-

ment requires such a division. It affords not only a clear comprehension of the problems of management, but also indicates a modern tendency to relieve the general manager of as many details as possible so that he may be ready to meet every emergency. The details of the administration are, therefore, left in the hands of the manager of production, the manager of sales, the manager of finance and the manager of accounting.

9. *Financial department as a unit.*—The manager of the financial arrangements in connection with the operative departments may have control of the cash, credits and collections. He may also act as inspector of all subordinate financial offices. But the financial operations of a business go beyond these matters. The financial specialist in large concerns handles such things as the marketing of securities. The position of the financial manager, when his functions are fully differentiated, would appear as in the following chart:

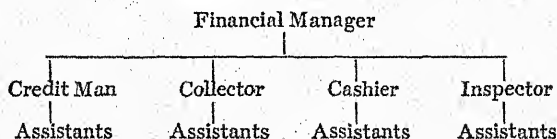


FIGURE 5.—ANALYSIS OF FINANCIAL DEPARTMENT.

10. *Sales department as a unit.*—The importance attaching to the marketing of goods has generally been recognized, but the peculiar conditions surrounding American markets have, until recently, made the selling of goods a comparatively simple matter. To get

salesmen with a "good front" or a "personality" seemed formerly to be the chief problem in sales management. Today this is all changed. It is stated on good authority that 30 per cent of the organization of the merchandising departments of the country under present management is unnecessary, and therefore an added burden of expense. The manager of a sales department must plan his selling campaigns with the thoroness of an army general. To the sales manager are referred all plans for the getting of new business, the problems of selling, competition, the making of sales contracts, the reporting of sales data and the inspection of sales agencies. The following chart shows the units that make up the sales department.

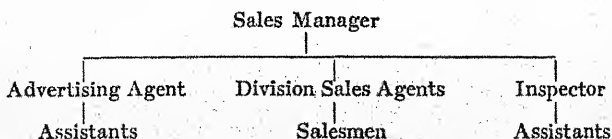


FIGURE 6.—ANALYSIS OF SALES DEPARTMENT.

11. *Accounting department as a unit.*—The manager of the accounting department has charge of all raw material, worked material and supplies. He likewise has charge of the inoperative plant and equipment and of all finished product. He investigates claims and procures, compiles and distributes all necessary records of conversion and operation. This department is responsible for the inspection of all records. An analysis of the accounting department follows.

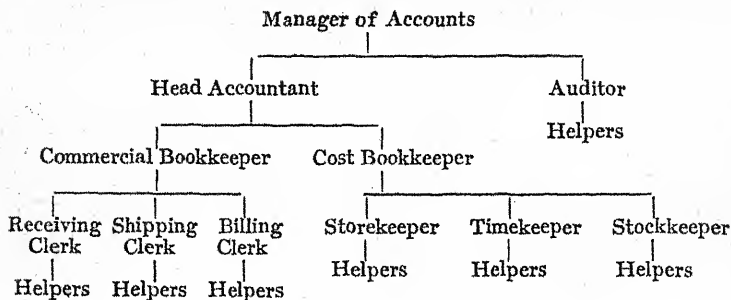


FIGURE 7.—ANALYSIS OF ACCOUNTING DEPARTMENT.

12. *Production department as a unit.*—Classifying the functions which belong to the production department and the sub-classification into still smaller units has constituted the chief activity of the modern efficiency engineer. According to him a redistribution of these functions is very necessary, but without going into the discussion at present let us see what natural divisions we should find under any system of management. The following chart (Fig. 8) will show that the manager of production should have charge of, and jurisdiction over, the plant and equipment, and the purchase of material, supplies and labor. He will also supervise the inspection of purchases and output.

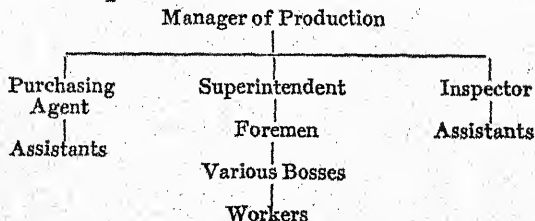


FIGURE 8.—ANALYSIS OF PRODUCTION DEPARTMENT.

13. *Management units the basis of organization charts.*—It has been said that 99 per cent of the enterprises now in existence have no such thing as a chart or diagram showing the essential units of which their organization is composed. Probably 50 per cent of the managers never heard of such a thing. No doubt, managers are not generally aware of the aid which such a chart would be to them. First, it throws into bold relief the whole organization; secondly, it shows, in a form that can be visualized, the weak or undeveloped parts of the management.

An organization that cannot be charted so as to show the well-defined relationships cannot be said to be scientifically managed. Mr. H. F. J. Porter has said:

Management is like a coaching outfit. The coach must be built right before its service is at its best. All its four wheels must be of the correct size and its body of correct proportions. The horses must be well-matched and strong enough to pull the coach. One must not be a dray-horse and another a trotter. The harness must be properly suited to the horses so that the collars will not chafe and irritate them and the traces must be of the same length, so as to pull evenly and not permit one horse to get his legs over the other horse's trace and interfere with him. If all these requirements are not met, there will be danger of not running straight. Merely speaking kindly to the horses, or patting them on the neck, or giving them sugar, or plying the whip, is not going to reach the cause of the trouble. But when this organization is properly arranged so that everything is in its right place, without overlapping or interfering, it is ready for the skilled coachman to get up into the box, take the reins and drive the coach over such roads as he may meet. There is

some assurance that it will stay in the middle of the road without any inherent tendency to go over into the ditch on either side. The man on the box is the manager, and upon his general knowledge of conditions and his skill in handling the organization will depend the efficiency of the organization. This man is an entirely different one, however, from the one who designed the coach or the harness, altho he should have very much to say about the selection of the horses.

Without going into the details of organization which this analogy suggests, it will be sufficient for present purposes to note that, generally speaking, any organization has four basic departments, which may be compared to the four horses drawing the coach. They are the financial, the sales, the production and the record departments. Each of these should be as independent in its action as any one of the horses, but all should be so thoroly related by their harness as to constitute a uniform and united force in pulling the business. In other words, these units of management should remain distinct, but their efforts should be so coordinated as to bring about a unified result.

14. *Duties of the management units.*—The duties of the corporate management, as we have seen, are (1) to furnish funds and (2) to determine the general commercial policy of the business enterprise. The second group of duties becomes a unit which carries on the productive functions; this in turn is divided into the staff organization—the chief duty of which is the advising of the general manager upon various technical matters—and the operating

unit, which is generally called the line organization.

The operating unit is the one in which we are at present peculiarly interested. This unit, as we found, was divided for purposes of more efficient management into four basic departments. The duty of the first of these departments is to collect and disburse the money. The duty of the sales department is to obtain orders for work by which the third or production department is kept going. The third department then converts into finished goods the orders which it has received. It will be noticed at once how dependent this department is upon the first and second departments for equipment, and then in turn how dependent these departments are upon the production department. If maladjustment is to be avoided, these departments must be equally balanced and normally independent. This requirement leads us to the fourth or record department, which is intended to keep account of all that happens in the other departments and thus maintain an operative balance. It provides records for the receipt of all raw material, holding it back until it is needed by the production department, keeping track of what the latter does with it, taking it back as finished products, handing it over to the sales department and telling the financial department how much it has already cost, how much more it will cost before it is sold, and how much should be added for profit in order that all the departments may be kept in good condition continually.

100 FACTORY AND OFFICE ADMINISTRATION

REVIEW

How do you distinguish between a plan of management and a system?

Point out the difference in the points of view which each of the following presents: economics, industry and business.

Under the designations of staff and line organizations, point out the chief elements which distinguish each.

Why have managers added a cabinet of experts to their staffs? What effect has expert management of financial matters had upon American industrial progress?

What argument can be advanced in favor of a manager's adding an expert production man to his staff who will hold the same relation to the company that the corporation lawyer does?

Outline the various functions, in the form of a chart, which will show in skeleton form the administrative organization of a typical factory.

CHAPTER IX

TYPES OF MANAGEMENT—THE FACTORY

1. *Thin red line of tape.*—A recent report issued by the Parliament of the Commonwealth of Australia, on Business Management of the Department of Home Affairs, gives the following account of governmental red tape: A school teacher in the Federal Territory of New South Wales wants a minor repair in a school closet. He writes thru the local inspector to the Department in Sydney, and the Minister addresses the Premier of New South Wales, who gravely addresses a letter to the Right Honorable, the Prime Minister of the Commonwealth, informing him that the woodwork of a closet is in a state of decay owing to the ravages of white ants, begging him to bring the matter to the notice of his colleague, the Minister of Home Affairs, with a view to the Administrator of the Federal Territory being instructed to have the closet mended, and concluding by having the "honour to be his obedient servant." The Prime Minister does as desired, and ultimately the work is put in hand. When the work is done, a notification is sent back by the same tortuous course. "Familiarity," says Mr. Mc C. Anderson, the investigator, "does not seem to lessen the shock one gets at the ex-

ceedingly long journey a very small matter has to take before it can be remedied."

National governments all over the world have increased their activities year by year until the administrative machinery threatens to crush its foundation. There is no necessity that the efficiency of government management be measured by the business standard—that the value of the product exceed the cost. The "system specialists" can work year after year without a check. Should they be compelled to study other factors, such as the necessity of raising money on a four per cent basis, or the problem of "stock turnover," governmental departments would purge themselves automatically of "figures not worth while." To show what red tape means in government practice would hardly be worth while, did not a somewhat similar condition prevail in nearly every large business organization. The introduction of improved methods encounters the universal aversion of business men to any increase in general overhead or office expense, which is fundamentally, tho not always consciously, based on a feeling of helplessness in regard to the control of those parts of an organization which cannot be checked by the "results" standard. There is no spirit of "business is business" to hold the system in the office to a definite end without meaningless excursions. The costs of operation of the department are covered by the general prosperity of the whole, and the only way the average business man knows of

handling them is to "play safe" and oppose organization expenses on general principles.

2. *Need of clear understanding of organization types.*—The idea that organization means red tape, and that red tape means more overhead expense, has done much to retard the general movement for more efficient management. Yet a very little thought applied along the right lines would show that red tape is only an exaggerated form of one feature in organization, and that it generally disappears as soon as real organization is introduced.

Let there be, then, a definite statement at the outset:

(a) No organization can take the place of business judgment, for organization is but a means to an end; it provides a method.

(b) The guiding questions in selecting a type of organization are: Does it permit the choosing of the things worth doing? Does it emphasize the factors that have the greatest bearing on the results, and permit the casting out of the unessential and insignificant factors?

(c) Organization as a system should (1) relieve the administration judgment of details, and yet bring to it the essentials necessary for correct premises, and (2) provide an orderly procedure for the carrying out of executive decisions when they are put into operation.

(d) The following factors, which make organiza-

tion, should be considered in the adaptation of the organization type to the character of one's business:

(1) Structure: lines of authority, responsibility, division of labor, system, discipline.

(2) Records: accounting, statistics, instruction.

(3) Esprit de corps: cooperation, team work.

(e) The managing principle by which every organization should be controlled is the *determination of the relative importance played by each of these factors*; since this is influenced by purpose, conditions and material, no two administrative policies would follow exactly the same course.

(f) The name or designation of a type of management depends upon the element (see d) which receives the greatest emphasis. Hence, (1) if lines of authority are emphasized in one way, the organization in which this occurs is called a "military type"; (2) if lines of authority are emphasized in another way, involving the division of labor, especially as applied to administrative functions, the organization is spoken of as a "staff" or "functional type"; (3) if system—accounting and other facilitating activities—is well-organized, then the type is known as a "systematized type"; if this feature is lacking, a general weakness of discipline prevails, and the organization is classed as unsystematized; (4) if a serious attempt is made to increase the esprit de corps thru committee work, then we have a type known as the "committee" form of management.

3. *Several differences between types.*—Just what

distinction is to be emphasized in the classification of staff and military types of management is not always made clear. The military organizations of today undoubtedly employ staff methods and have developed them to a high degree of efficiency. The contrast which most writers have in mind when comparing the staff with the military type seems to be the method of exercising control of the business, or the execution of orders and commands. The military type suggests a domineering attitude, an autocratic method and promotion by seniority. The staff implies specialized knowledge, conferences and advancement thru proved fitness. The military type is usually described as a one-man power having for its ruler a despot who determines his actions by the standards of inherited information, and who manages his business by rule-of-thumb methods. The staff type is pictured as being just the reverse of this. Here the manager is supreme in command, but he is advised at every step by experts whose information upon their specialties is the very latest that can be found. Neither snap judgments nor empiricism is in control.

4. *Why type distinctions grew up.*—Since there is so much discussion on the subject today it may be well to state the case somewhat more at length than the importance of the distinction between the military and the staff types warrants. The distinction has grown up largely thru the attacks of industrial engineers upon the present system of industrial organization. They found most of the industrial plants of the

country poorly managed because in most cases one man was trying to do everything. The manager, finding his powers limited in time and space, put much responsibility upon the superintendents. These, in turn, forced the work of carrying out orders upon the foremen. The latter, becoming overburdened, were compelled to rely more and more upon the judgment and initiative of the workmen. This system brought the burden of the work and responsibility upon the very men who were least able to bear it. Disorganization and great waste were the results. Since the manager with his superintendents, foremen, etc., suggested the army organization, the name military was attached to it. This military form became associated with poor management and extravagant waste in production. Then came the discovery that some concerns had increased their efficiency by hiring expert chemists, draftsmen, students of labor questions, etc. This at once suggested the staff organization. The system was then developed so as to put most of the important functions of management under the guidance of a body of specialists. A business, therefore, which had such an addition to its managerial equipment was spoken of as being organized on the staff principle.

5. *Staff and line in business.*—One firm which uses the distinction between staff and line officers is the Sherwin-Williams Paint Company. The principal office experts, such as Chief of Motor Power or Varnish Sales Department Manager, without having ex-

ecutive control, confine their attention to the working out of the best methods and the adoption of the best standards. The control is with the line or territorial managers. The company holds that the technical man is doing his best work when he is showing another man how to do it. The specialist is particularly needed during the period when construction and installation are taking place. The salesmen in the field should be instructed so that they may meet ordinary business contingencies.

6. *Functional type, the factory.*—Under the older forms of management much depends upon the foreman's ability to grasp the larger problems of the manager's policy. In arranging for the work of the foreman, it has been determined of late that the same process shall be adopted in developing efficient specialists here as was done in the case of the common laborer. Each foreman, instead of having charge of a number of men performing many kinds of work, has now one thing to do. This was found necessary because capable foremen with broader ability were difficult to find. Such general work demands of a foreman that he have a fair quota of brains, some general education, fair physical health, some technical knowledge and some manual dexterity. In common with all administrative positions, his position calls for tact and judgment. He must have a knowledge of every part of the product; he must see that the workmen use their time for the best interests of the company. He must be a "hustler" himself and he must know how

fast other men can work. His duties include the disciplining of the man, the settling of disputes between employes, and the adjusting of wages in case of absence, sickness and so on.

7. *Functional method of organization.*—The difficulty of getting men of the proper caliber to take charge of the departments has set managers to devising a method or organization which calls for less ability in any one foreman. Accordingly the functional method of organization is gradually supplanting the military method. In an organization of this kind, a man possessing three or four of the above qualifications can be trained to fill the position of a functional foreman. He is required generally to do only two or three things, and in the larger shops only one thing. This does not mean that the same amount of ability, taking the shop as a whole, is not needed under the functional plan, but that it is organized differently. All the ability which is needed for planning is concentrated in a planning department. The shop foremen are no longer expected to do this planning. In a fairly large factory there will be four foremen in the planning department, and another set of four foremen will be constantly upon the floor of the shop, instructing and helping the men. This division of labor causes no confusion, for the workmen never see the foremen in the planning department. This illustrates how all the functions may be separated and, whereas the old system provided one foreman from whom a group of men took their orders, the newer method per-

mits any workman to have as many as eight bosses.

8. *Foremen of the planning department and the shop.*—The foremen in the planning department are (1) the route clerk, (2) the instruction-card man, (3) the cost clerk, (4) the time clerk. The duties of these men are fully treated in Chapter XII on planning in the factory. In the shop there are (1) the gang boss, (2) the speed boss, (3) the inspector, (4) the disciplinarian. These men can be selected without difficulty, and their training can be provided for if the manager has a clear idea of what he wants to accomplish.

The gang boss has no definite duties as such. He simply carries out such work as the planning department assigns him.

The speed boss sees that the work is carried out according to the schedule sent out by the planning room.

The inspector looks after the quality of the work as it comes from the machines. He must be able to instruct the men as to the type and quality of workmanship required.

The disciplinarian settles all cases of insubordination, and passes judgment upon the disputes which arise between workmen and foremen.

There is a fifth boss in some factories, whose duty it is to keep the machines clean and in repair.

9. *Unsystematized type of management.*—In an unsystematized plant the chief characteristic of the management is the lack of a proper system of cost accounts, and an inadequate method of keeping the ac-

counting information in good shape. In so far as every management must depend upon its cost and financial records in order to meet market competition, the unsystematized plant is at a distinct disadvantage. Inadequate cost records are the cause of many losses and failures. It is a frequent experience of certified public accountants, on being called in to examine books of account, to find that the firm is losing money.

When a competitor discovers the fact that his rival is not keeping close account of costs, he is sometimes able to purchase the goods more cheaply from the firm which keeps inaccurate cost accounts than to make them himself. It is said that a large department store which had for years done its own printing, finally ceased this branch of work because it discovered that the printing trade in general kept very inadequate records of its costs. It then adopted the method of sending for estimates to a large number of printers whenever it had a job which it wished to give out. All of these estimates were to be based upon a printed sample which the store sent to the various printers. The manager was safe in choosing the lowest bid submitted, for without fail some of the bids would be below cost.

Under the unsystematized type of management the accounting generally consists of a statement prepared some time after the annual or semi-annual stock-taking, and shows the profit and loss, and the assets and liabilities. In most cases, however, such a record is chiefly of historical importance. If the statement is

bad, it is too late to remedy the troubles of the previous year, because it shows merely the result of that year. If, as is likely to happen where there is little system, the yearly statement is delayed, the record becomes too ancient to be of much use. It frequently happens that firms whose fiscal year ends in January do not know the result of their year's business until six months later, and then only in the form of statements as to profit and loss and assets and liabilities. Some of the information is eighteen months old and it all comes too late to stop any of the leaks.

10. *Majority of industries unsystematized.*—It is probably safe to say that the great majority of the firms of this country belong to the unsystematized type of management. The prevalence of this type in America is due in a great measure to the large margin which has existed between the cost of production and the selling price. Many firms with a large margin of profit have paid little attention to scientific accounting; but conditions in this respect are changing and the number of systematized concerns is growing every day.

11. *Systematized type of management.*—Under the systematized type, the managers are methodical and systematic; each department has been studied and systematized until, so far as records go, the firm knows exactly where it stands at all times.

The distinction between the systematized type of management and the unsystematized is seen in the different emphasis which is put upon the accounting.

Instead of vague reports made once or twice a year, the books of the systematic type of management show the conditions of the business quarterly or monthly, and in much detail. Four new features usually appear under this form of management: 1. Reports comparing last year's cost with this year's costs. These may be made on the basis of a department or of a certain product. 2. There will be costs, showing material and labor value. 3. In addition to the determination of these direct costs, there will also appear a practical method whereby overhead charges may be equitably distributed. 4. The results of the business will be periodically put before the manager in a simple but comprehensive table or chart.

12. *Cost records highly developed.*—The cost records give systematized management a distinct advantage over the unsystematized types. Correct cost accounts are relied upon to establish the selling price, and to point out excessive costs and indicate, perhaps, where they may be reduced. Many managers, therefore, believe that when they have a systematized plant they have also an efficient plant. It is just at this point that the advocates of the new scientific management take issue with them. They point out that system helps only one function of management and that even under the best systematized methods many defects might be discovered pertaining to the system itself which would be eliminated under the efficiency or scientific type of management. These critics point out, for example, that the same general system of ac-

counting under the systematized type does not extend to the whole plant. To illustrate, the clerical work in the different departments may not be included in the cost accounting. The close analysis to which the unsystematized type of management has been recently subjected has set a new standard of accomplishment before the management. To attain results new methods of management, based upon close analysis, are proposed. As these contrast sharply with the older methods, a new type has been established.

13. *Committee system*.—One method which is coming more and more into use is the committee system of management. It is an attempt to apply the same democratic principles of government to factory management that are embodied in the national and state governments. The primary idea is to enlist the cooperation of the men in the shop in forming plans and offering suggestions for the good of the company. By means of frequent meetings and a thorough airing of opinions an *esprit de corps* and a feeling of responsibility for the success of the business as a whole are established. In its method this system is the opposite of the military type of management. The committee system is especially well adapted to furnish a means by which the discontented can give expression to their feelings, and affords a valuable aid to the management in locating the cause of any disaffection. Furthermore, it is claimed for this system that it provides a method of overseeing whereby an executive totally ignorant of shop and sales processes

is provided with reliable data concerning any weak spots in the production, buying or selling department or in the office.

14. *Work of the committees.*—The work which forms the basis of each committee discussion must be in harmony with the purpose of each committee. The following will be suggestive in showing the fundamental problems which, in some form or other, must be considered:

1. Routine work and report of progress.
2. New designs and inventions.
3. Cost reductions and economy.
4. Plans to standardize products.

15. *Special types, divisional and departmental.*—One of the great problems of railroad management is to overcome the difficulties imposed upon it by the great distances which separate the operating department from the source of control. To look after the details of operation of any railroad four or five thousand miles long would be beyond the capacity of any general manager. Accordingly, the operating territory is generally divided into districts and its management put in the hands of subordinates. The division may be long or short, according to circumstances. For example, the Pennsylvania Railroad station in Philadelphia is the head of the Philadelphia division, but the average length of the divisions of this same line east of Pittsburgh, outside the big cities, is 150 miles. That the details of a territory as large as this may be managed, considerable power must be vested

in some local authority. The divisional superintendent, under this type of management, is therefore a man of importance.

No matter how capable a man the superintendent may be, he cannot be an expert in several directions. If he is a good operating man, he is likely to be unfitted for the work of a civil or mechanical engineer. Hence the rise of a departmental type of management, in which the operating superintendent confines his work to his specialty, i. e., to the operation of the trains, and is aided by experts in mechanical and civil engineering. Under this departmental management the divisional superintendent does not have absolute control over all activities. For example, if two engines are to be repaired and the division superintendent wishes the work done at once, he must first take up the question with the superintendent of motive power, who is an expert in such matters. The latter officer, however, not being connected with the local division staff, after having considered the advisability of the repairs, would then refer the matter to the master mechanic who is located in the division superintendent's territory.

Before the recent discussions on the subject of business efficiency became so general, there were three types of management, and this classification to cover the whole field in a much broader way than the more recent ones. These types were the traditional type, the transitory type and the functional type of management.

It will not be necessary to discuss the first two types, because they cover in a general way the kinds already described. The boss, military or strenuous types of management would fall under the traditional plan. When this plan has been improved upon by the adoption of more systematized methods, the type is spoken of as transitory. The third type, or the functional, has been described above. Since these three types embrace all the others we may briefly review their characteristics and see their contents more clearly if we study the following synopsis as it applies to the stores department.

TRADITIONAL TYPE	TRANSITORY TYPE	FUNCTIONAL TYPE
1. Does not realize that proper space for storage is important.	1. An equipment properly arranged for storage.	1. Physical appearance resembles Transitory Type.
2. May be general store-room, but all the stores seldom found there.	2 (a). Various departments often have their own stores but not under central control. (b). Everything arranged in neat and orderly manner.	2. (a). Central control of department stores. (b). Proper system laid out in orderly way.
3. No system in piling stores. Generally put in place most convenient at the time.	3. Everything is kept in its place.	3. Provision for holding and piling stores.
4. No person to assume and carry out responsibilities for the order in which stores are kept.	4 (a). Storekeeper issues all stock, but no central office control. (b). Stores issued on requisition only. (c). Storekeeper has assistants for moving stores in and out.	4. (a). Balance-of-stores clerk controls all materials from central office. (b). Materials delivered on requisition only when assigned by stores clerk in central office. (c). Storekeeper has assistants. All act on orders from central office.
5. Proper records of stores generally missing.	5 (a). Perpetual or "book" inventory kept in office but seldom predetermined maximum and minimum requirements. (b). Office Book inventory is balanced with stores sheets (ledger sheets) kept and once a year the balance checked against actual physical inventory of stores.	5. (a). Ledger sheets in central planning office have maximum and minimum requirements for each kind of material. (b). Balance-of-stores sheets (ledger sheets) kept in the central office. Upon these the location of material is shown. (c). All bookkeeping for stores done in central office.
	6. Some kind of division and classification of stores will be found.	6. Symbols used to designate different kinds of stores.

TRADITIONAL TYPE

TRANSITORY TYPE

FUNCTIONAL TYPE

7 (a). Sometimes a central planning station is found.

(b). In the station the operations for each process are written out before work is started.

(c). Where planning station is not in operation, materials are often wanted before it is discovered that some part or material is missing.

8. Supply stores, such as belting, electrical appliances, etc., are not usually put under the general system of stores.

7. (a). All work on materials planned ahead in planning department.

(b). All planning done before operating departments need them.

(c). Materials running low noticed at once and a supply obtained before operations begin.

8. System covers all supply stores.

9. Special men, called "move men," take and remove materials to and from machines, thus relieving workman and keeping him from looking for or waiting for his materials.

10. Fire protection.

16. *Work planned ahead.*—Perhaps the broadest contrast between the functional type and other types is in the planning of all the work for each workman ahead of time. The principle by which this kind of management gains control of the operating elements is that of planning completely the proper execution of the work before a single move is made. A route sheet showing the names and order of all the operations which are to be performed is made out, and instruction cards are clearly written for each operation period. Requisitions on the stores department showing the kind and quality of the materials and where they should be moved, and the list of proper tools for doing the work in the best way, are prepared for each operation and the very best methods for performing each operation are determined in advance and embodied in the instructions.

17. *Shape the man to the organization.*—Shape the

man to the organization, not the organization to the man. A wise policy dictates that the best men should be placed at the head to plan and organize the work for less able men. When exceptional men assert themselves they should not be allowed to break down the machinery and do the work single-handed, but they should at once be given important positions where, by constructive work, they can strengthen that machinery. In fact, it is to such exceptional men that the rule applies with special force, "Let no man become indispensable." If he does, the organization collapses with his exit. Instead of building up the company, he ruins it. The notable tendency of our time, in accord with which successful individuals have incorporated their undertakings, thereby voluntarily subordinating themselves to their ideas, shows that the really big men recognize this impersonal nature of organization. The method of the efficiency engineer is distinct, not because it enumerates new principles, but because it applies in greater detail and in a more systematic way principles which are well established and in universal use.

18. *The primitive type for small firms.*—The most primitive form of management and the form which is still the most efficient in small matters is found in those cases where the owner carries "his office in his hat." This primitive owner or foreman performs each one of the functions of management. He plans the work of the office, he digs up the information he needs, he provides the necessary machines and materials, and he

hires and instructs his workmen. When the establishment grows beyond the capacity of one head, some or all of these functions must be delegated to others. The owner hires a draftsman, a bookkeeper and a foreman, and lets the latter hire and instruct the workmen. As the work increases other departments are added as needed, and the organization becomes more complex. Permanent progress in this world is, after all, a process of evolution, not revolution. Steadily from generation to generation the efficiency of manufacture, of agriculture, of transportation and of all the many other activities which form a part of our complex civilization, has increased. And since our methods are still far from perfect, we may look forward to similar or even greater progress in the future.

REVIEW

What danger to efficient management is likely to arise when a factory or office grows very large and the activities become numerous?

Why do business men object to the introduction of new methods and systems into an office or factory?

If you were asked to distinguish between "red tape" and organization, what series of statements could you make to show the difference?

How is the principle of specialization in management being worked out with reference to the foreman?

What is meant when the remark is made that the majority of industries are unsystematized?

Show how the cost records of a factory may be taken as a guide in deciding to what type of management the factory belongs.

What representative form of government is being used in business management?

What element clearly marks off the functional method of management from all others?

CHAPTER X

TYPES OF MANAGEMENT—THE OFFICE

1. *Function of the office.*—The function of the office is to facilitate the work of production and distribution. In other words, here is the place from which the facilitating activities are directed. In its usual sense, the “office” is the part of a business establishment in which the administrative and clerical work is performed. That is to say, if the vice-president happens to have charge of the factory, his headquarters are said to be “in the office.” The department of the sales manager, the advertising manager, treasurer and accountant are also regarded as parts of the office. But for our purpose—that of laying down basic principles in the management of the office—we must adopt a different point of view.

It has already been explained that, generally speaking, a business is divided into four basic departments—the production department, the sales department, the financial department and the accounting department. Each has its own specific functions to perform. The production department supplies the article to be sold, the sales department is concerned with selling it, the financial department collects and disburses the money involved in the conduct of the entire business, and the accounting department records all

the transactions, summarizes the facts and presents the results in statements and reports for use in further operations.

The office, as we shall have to regard it, performs the clerical work required by these four departments. In the production department, records of orders, quotations, invoices, stock, requisitions and the like are constantly needed. The whole attention of the factory superintendent or manager should, theoretically, be devoted to the efficient production of goods. This calls for the use of all his skill and ability in the handling of machinery, plant, men and materials. He is interested in the clerical work only as it is an aid in the performance of his duties. When he is about to purchase a new machine, for example, his interest does not lie in how the quotations are filed, but in the bids themselves. If the factory manager is uncertain as to the specifications on an order going thru the plant for one of the customers, he wants the original order when he calls for it. He does not care how the order is found; he wishes only that it be brought to him promptly.

There are also sales records and statistics, follow-up files, prospect lists, clippings, electros and other material which must be cared for. The sales manager, like the factory superintendent, is supposed to give his whole thought and attention to increasing sales. It is necessary that the sales records be reliable, and that they be on hand when wanted. Further than that the sales official's interest does not go.

The financial department also has its records, such as credit information, lists of delinquents and the like upon which it relies in conducting its operations. The accounting department requires sundry clerical work, such as billing, filing vouchers, etc.

In addition, the four departments referred to receive and send out mail, which must be typewritten, filed and otherwise handled. There are other details incident to the routine of every office, such as the operation of duplicating, addressing and other machines, and attending to callers, errands and inter-office communications.

All these details fall within the scope of the office proper. From a management point of view, then, the office may be defined as that part of a business organization which performs the purely clerical work necessary in the conduct of the whole business.

2. *Elements of management applied.*—The same cardinal elements of management discussed in previous chapters are present in the management of the office. In other words, we face the problem of directing forces or energy toward the fulfilment of a purpose. There are, for this, two kinds of energy—human and mechanical. The *purpose* of the office is to provide the clerical work necessary in the conduct of the entire establishment. To perform this work expeditiously and efficiently contributes to the profit-making of the concern in the same sense that increasing sales or reducing the cost of production does.

The first step should be a study of the work required of the office, as we now understand the term, and an analysis of the amount of energy available. To put the matter more concretely, we may compare the office manager's work with that of a contractor about to build a schoolhouse or other building. His plans and specifications are laid before him. He knows what is wanted. He knows, too, that he has so many men, so many dummy engines, and so on. The men and engines represent a given amount of energy, which the contractor measures by the amount of work they can perform. A bricklayer can lay an average number of bricks a day; a forty-horse-power engine can move an average number of loads a day.

The office manager may have five, six or more departments to serve. Each department requires certain services which are approximately determinable. These services are the "results" required of him. He studies the people on his force and the mechanical appliances at his command. The efforts that the two groups put forth represent the energy under his control. He, too, measures energy by results. For instance, he realizes that while a typist can turn out about 900 lines a day, a duplicating machine can produce about 35,000 form letters a day.

Knowing what the office can do, with its present equipment of people and machines, the office manager must determine whether the existing standards are sufficiently high and, where possible, must raise the standards, thru the introduction of new methods or a

better grade of help, or by reorganizing the work where reorganization is required. This really is the axis around which all the office manager's duties revolve.

3. *Office head.*—The term "office manager" has been used above. Since the duties properly within the scope of the office may be separated from other duties, and since the management of the office may be considered as a separate function, it would seem that there should be an official who would be specifically responsible for its efficient conduct. Theoretically this is true, and in many large concerns, such as the Westinghouse Air Brake Company and branches of the United States Steel Company, there is actually such an official. In the majority of cases, however—particularly in medium-sized and small concerns—this duty is either divided among a number of department heads or is only one of a number of duties assigned to an officer also in charge of some other branch of the concern's activities. This feature is considered in a later section of this chapter. It is desirable now to inquire into the necessary qualifications of the person or persons charged with governing the office.

We have seen that the office proper is in close touch with every other department in a business establishment. As a matter of fact, it is an essential to the efficient conduct of these departments. What would be easier, for instance, than to frustrate an important plan for increasing sales by neglecting the clerical features of the plan? Or if the financial department

were contemplating a special campaign to stimulate collections during a month usually "slow," the person in charge of the clerical work, failing to comprehend the importance of the movement, might easily cause a loss of several thousand dollars by postponing attention to certain details in favor of "more pressing things to be done." It is highly desirable, then, that there be complete harmony between the office and all the other departments.

There is a corollary to this conclusion. The persons in charge of the office must be thoroly familiar with the purposes and policies of all the other departments, and must be fully aware of the import of every move that is made involving clerical work. This would hardly be possible unless these persons understand the principles that underlie the conduct of business in general. Knowledge of what the sales department is for, of how it operates, of the method of the work in the production, financial and accounting departments is important to the office head. He should also, of course, be thoroly familiar with the subject of organization and management and should be in touch with all the modern office methods and devices. In addition, he should possess the natural qualifications of any leader—tact, precision, sympathy, forcefulness and a keen, accurate perception of the details of problems presented for his decision.

4. *Selecting and handling employes.*—The problem of directing the office force so that its members will work harmoniously and with maximum efficiency

is one of the hardest to solve. Yet the principles of good administration are as capable of application in the management of an office as they are anywhere else.

It is important, first of all, that proper care be given to the selection of employes. The fourteen-year-old applicant for the office boy's position should be a future executive. He should be examined with that end in mind, and his physical and mental characteristics should be carefully studied. During the last few years much progress has been made in establishing scientific physical tests. Some of the large concerns have installed medical departments for this sole purpose. The education, home surroundings and future ambition—all of which may be determined by discreet questioning—are also important barometers in helping an employer to judge the ability of a person to perform the work to which he or she is assigned and the probability as to whether the employe is likely to advance to a more important position.

Coupled with the selection of employes is the importance of assigning to them the duties which they are by nature best fitted to perform. This seems obvious, yet how many clerks are at the billing desk when they should be order clerks or entry clerks? In cases where there is an original examination such as has just been discussed, it is only a matter of carrying the process one step further and determining what qualifications are necessary to the performance of a given kind of work. In the mailing department of one of the large publishing houses, for example, it has been

proved that an active, nervous girl can turn out more work than a calm, self-contained girl, even tho the latter may move decisively.

The welfare movement which had its inception in factories is now being applied to offices as well. In many of the large companies, like the Metropolitan Life Insurance Company and the American Telephone and Telegraph Company, light, airy lunch rooms are provided, where wholesome food is tastily served at low prices. The National City Bank of New York, Spencer Trask & Company and other large companies have provided club rooms, libraries and recreation rooms where office employes may gather after office hours and listen to lectures on business subjects, discuss outings and so on. All these movements should be encouraged and aided by office managers and by the heads of concerns. They stimulate among the employes loyalty, cooperation and an interest in one another which in the long run result in an increased interest in the work.

5. *Establishing standards.*—Office work does not lend itself well to scientific management. Yet it is possible to establish standards and by means of reports to determine the efficiency of employes. Marshall Field & Company of Chicago, the Simmons Hardware Company of St. Louis and other concerns have, for instance, placed their typing departments upon an efficient basis in the following manner: By means of a register which records the number of strokes on the typewriter keys they obtain a fairly ac-

curate record of each girl's output. In other cases the number of lines (of a given length), or the number of words, is counted by the chief of the typing department. The following is a sample week's record in one of the concerns which use the line method of calculation. The high records were made by operators on dictating machines turning out standard paragraph letters, while the lower records were made by beginners or by girls on difficult dictation. The initials in the top row indicate the correspondents who dictated during the week; the names of the typists appear in the left-hand column:

	TAT	LRS	BMO	FL	BL	EW	CM	HE	HT	COPY	TOT.
Miss Smith	270	670	585	....	750	....	1,065	60	1,240	4,640	
Miss Jones	85	...	4,900	....	...	....	145	95	415	5,640	
Miss Brown .....	...	...	310	4,870	...	....	590	...	300	6,070	
Miss Richards .....	...	...	....	250	...	3,900	150	...	1,545	5,845	
Miss Hart .....	...	...	655	850	...	....	420	...	2,040	3,965	
	355	670	6,450	5,970	750	3,900	2,370	155	5,540	26,160	

These records form the basis of a bonus system. Any such bonus system must necessarily be elastic and more or less arbitrary. In this particular case the committee which awards the bonuses takes into consideration the number of lines, the nature of the work and the accidents and other delays reported. The operators cannot tell in advance just what their bonuses, if any, will be. Their reliance on the fairness and judgment of the committee, however, helps to make the system effective. In addition, the figures posted on a bulletin board arouse a friendly competitive spirit.

Many large concerns have discontinued bonus and piecework systems in the office. The American Law Book Company of New York tried a piecework system but gave it up. So did the Sears, Roebuck Company of Chicago. At one time five hundred clerks in the entry department of this company were paid on a piecework basis, but the plan was found impracticable.

6. *Military type of organization.*—There are three types of office organization: first, the military type; second, the functional type; third, a combination of the military and functional types, which may be termed semi-functional. In the military type, which is the most common, the head of each department controls all the work that is performed in the department, irrespective of its character. The sales manager, for example, not only is provided with assistants for writing to salesmen, for handling mail-order work and for other purely sales activities, but in addition has his own stenographers, typists, statisticians, file clerks, mail clerks and errand boys. The sales department, under these conditions, becomes practically a business office in itself. On the one hand, it is credited with sales and on the other hand, it is charged with its expenses. This is an easy method of determining the exact ratio of sales expense to income. As has already been pointed out in an earlier part of this book, however, the military form of organization is obviously inefficient for the sales department, for under such a system this department is forced to perform functions

entirely outside its scope. The selling type of mind is different, as a rule, from the type needed for the efficient regulation of routine.

The same basic objections apply to the military form of organization in the other departments.

7. *Functional type.*—The separation of strictly office work from that within the scope of the sales, production, financial and accounting departments is similar to the change which takes place in the factory organization when the functional type is substituted for the military. The duties of the gang foreman, in the latter case, are distributed among a number of functional foremen, each with his own special duty to perform. In the office, the department heads confine their energy to selling, manufacturing, financing or accounting, as the case may be. The specialized function of managing the office is turned over to a person trained for this duty. Frequently we find an officer—usually the accountant—performing the dual task of running an office and one of the four other departments. While this arrangement is sometimes expedient, especially when a concern is not large enough to warrant the employment of an office manager, it does not conform strictly to the accepted idea of a functional organization.

When the functional idea is in force it is carried out, so far as possible, thruout the entire office organization. Except in cases where there is not enough work to keep a person busy, one specific task is assigned to

each employe. Functional organization in a modified form is illustrated in Figure 9.

During the change to the functional scheme of organization, in this case, numerous instances were discovered where one clerk could do the work that had formerly occupied two. The office, in this organization, is a separate department directly responsible to the executive committee. It is not a subdepartment of any one department, but a subdepartment of them all. All the clerical work is under the supervision of the office manager, and he has his subordinate chief clerks, whose duties are also specialized. The functional idea is carried to its consummation in the collection department where each clerk has one task to perform. One checks bills, receipts and addresses, another types form letters, another enters remittances, and so on.

8. *Semi-functional organization.*—We frequently find an office organization almost on a functional basis, but still adhering in minor respects to the old scheme of management. For good reasons, the various departments retain their own stenographers and one or two special clerks. The work may be of a confidential character, or the clerk may need specialized training that can be obtained only by carefully obeying the head of the department or his assistants.

The organization of the office in the White Company, Cleveland, Ohio, manufacturers of motor cars, is of this character. In this company the sales de-

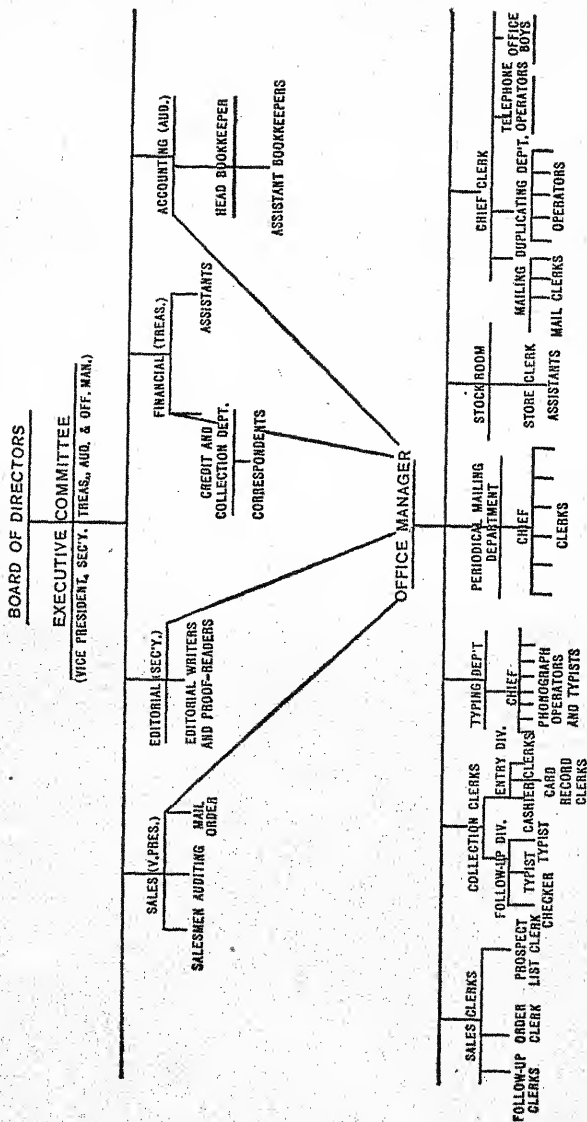


FIGURE 9.—ORGANIZATION CHART OF A PUBLICATION HOUSE.

partment is in two divisions, one in charge of the second vice-president, the other under the jurisdiction of the secretary. The auditor is also office manager, but various sales departments and subdepartments have retained some clerical help. The advertising department is a typical example. Specially trained clerks are usually necessary in advertising work and we find that special stenographers and clerks are assigned to this department.

9. *Committee system.*—The committee system is employed in the office with excellent effect. In Figure 9, it will be seen that the office manager is a member of the executive committee. The value of this arrangement is evident when it is remembered that the force he controls is in constant attendance upon the departments of which the other members of the committee have charge. Thru the committee meetings the office manager keeps in touch with the plans and policies of the various departments, and is thus enabled to direct his force with an intelligent regard for that work which should take precedence over other work. Here, too, he learns of the shortcomings of his force, receives suggestions that add to its efficiency and imbibes the spirit of the entire organization, which in turn he communicates to his department heads thru an office committee. The office committee is composed of the office manager and his chief clerks. The frequency of the meetings of the executive committee and the office committee depends upon the nature of the business. The former usually meets more often than

does the latter. There is danger of carrying the committee system too far, just as there is of not carrying it far enough. The routine of the day should not be broken any more than necessary; it is often advisable, in fact, to hold meetings during the lunch hour or on Saturday afternoons.

10. *Suggestion system.*—The suggestions offered by office boys and other minor employes frequently surprise even the most ardent advocates of the suggestion system. The usual plan is to offer two or three definite money prizes for the best suggestions turned in during a given period, say one month. The suggestions are unsigned, a copy being kept by the author. They are deposited in a box designed for that purpose, or are laid on the desk of the office manager. Either the executive committee or the office committee passes on the various suggestions submitted and awards the prizes, posting the winning suggestions on a bulletin board. The contributors submit their copies, receive the prizes, and their names are then written on the posted documents. Suggestions in regard to providing a motor for a hand-driven device, reducing the sizes of various pieces of stationery to avoid folding, pasting carbons to letters instead of pinning them, thus saving space in the files and the cost of pins or clips, and other ideas of this sort are the most common. Very often, however, advertising and selling ideas and suggestions of similar importance come from the most unexpected sources.

11. *Arrangement and lighting of office.*—While the

subject of office arrangement might properly be treated under the head of organization it is, nevertheless, an important element in the management of the office and may well be considered at this point.

The arrangement of desks, filing cabinets and other equipment depends much upon the type of organization. Under the functional type, where the filing is concentrated in one department, where the typists are gathered under one chief and the other functions are similarly segregated, it is obvious that the equipment is grouped according to the departments. The problem then becomes one of allotting the proper floor space and position to each department. The general principle of progression should be adhered to as far as possible. It is usual to follow the course taken by the orders received. This is illustrated by the floor plan of the office of a large clothing house in New York (Figure 10). The orders are first laid on the president's desk. From there they go to the credit department, and when the sales manager receives them he knows whether or not they are approved by the credit department. After receiving his approval they proceed to the order department, where the production orders are made and the proper copies sent to the filing department for the sales and other files, to the billing department and to the factory superintendent. The latter is not far distant from the purchasing agent, with whom he is in frequent communication. The treasurer is located close to the credit and accounting departments. The shipping slips come up from

the shipping department, on the floor below, to the billing department, which is across the hall from the accounting department. The filing, mailing and

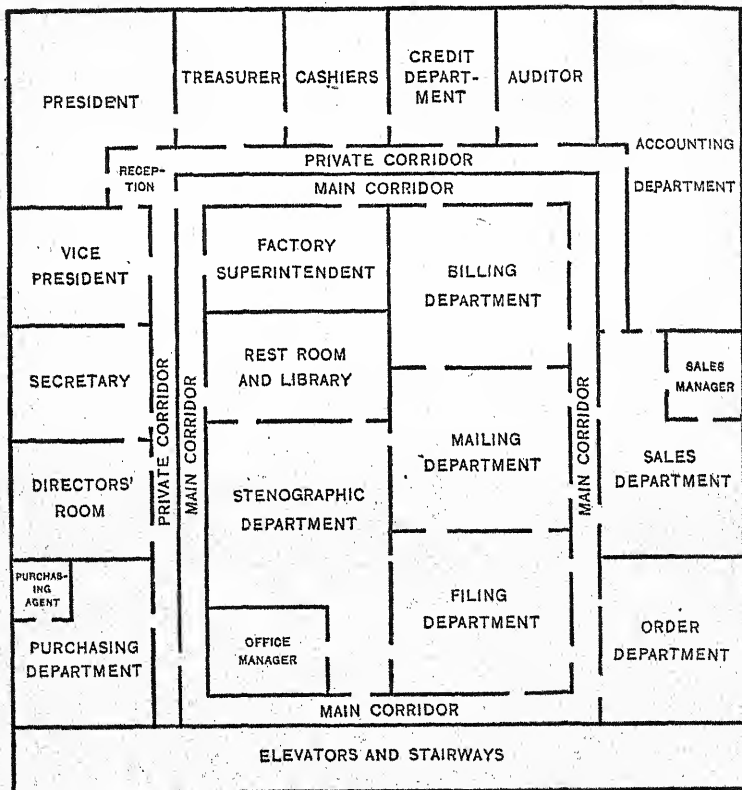


FIGURE 10.—FLOOR-PLAN OF OFFICE IN NEW YORK CLOTHING ESTABLISHMENT.

stenographic departments are also conveniently located. There is very little doubling back in this office.

Care should be given to the proper lighting of the

office. Poor light is responsible for much of the inefficiency in office work. Lighting has been reduced to a science, and it is in most cases advisable to call in an expert. Sometimes it is found cheaper to instal an indirect lighting system; in others, a direct system with properly diffused light is better. The candle-power, the kind of shades, the distance of one light from another and from the work—all these are important points to be considered.

REVIEW

Study the full significance of the term, "facilitating activities," as applied to the functions of the office.

Should the activities of the office be looked upon as non-productive in the sense that these activities do not help produce profits or produce the goods?

Why can the cardinal principles of management be applied to the office organization as well as to the factory?

What vital principle in management would you say has been violated if, upon thoro investigation, you should find numerous "misfits" at work on the various jobs in the office?

Do you think it advisable to establish as many standard operations as possible in an office? Why?

Show how you would apply the functional method of organization to an office.

An expert in gas illumination advised a manager to change his method from one involving a central source of lighting to one by which each desk is lighted individually. The manager dismissed the expert without listening to his argument. On what particular point would you judge the manager to be weak as an executive?

CHAPTER XI

MODERN AIDS IN MANAGEMENT—PLANNING

1. *Real management is concerned with policies, not details.*—Most managers will admit that they are handicapped because they must attend to too many details. Foremen, superintendents and bosses will generally admit that they are overworked. Yet if a superior officer should suggest that some of their duties be lightened or removed, how many of these men would submit without any protest? It is this factor more than any other in human nature—the unwillingness to surrender any fraction of authority—that stands in the way of progressive management. One frequently hears the remark made that the head of the concern is the last one to be convinced that his own organization might be helped and his own effectiveness increased if some of his responsibilities were shifted to the backs of other men. He is more likely to object, because he has more authority to surrender than the men below him.

2. *Adjusting authority to responsibility.*—However strenuous may be the objection in certain quarters to any particular system of scientific management, it is generally conceded that there are certain aids which will help the manager to lighten his burden and in-

crease his efficiency without lessening any part of his total authority. Not all of these aids, of course, can be mentioned, but a few which have been tried and found successful will be given. Perhaps the simplest is a chart showing the form of the organization, the effectiveness of which will be much increased if it is supplemented by an organization record. Other devices which are gradually being adopted, as a whole or in part, are the planning department, time-studies, standards, mnemonic symbols, bonus rewards for labor and welfare work.

3. *Organization charts a prime requisite.*—A chart showing clearly the line of authority and responsibility of each individual in an organization will go far toward removing many inter-departmental jealousies. The chart should be so simple that it will be self-explanatory upon inspection. Each man's position is thus made perfectly clear and he easily informs himself as to what course to take when transacting business with other departments. If the chart is for a factory, each workman will know to what particular gang boss or job boss he is directly responsible; each gang boss or job boss will know to what foreman he must report; each foreman will know to what superintendent he must answer; and each superintendent will know where his authority begins and ends with respect to other departmental heads. Furthermore, the chart should show who is responsible for machines and equipment. To be most effective the chart should be hung in a conspicuous place. Each of the manufac-

turing departments should have one, as well as the office; 24 x 36 inches is a suitable size. When made in the form of blue-prints, charts are inexpensive, but they should be framed and protected by glass, to shield them from pencil markings and other injuries.

4. *Charts clarify ideas.*—These charts will not only prove themselves an aid in instructing the employes in the workings of the organization, but they will be found to be of great value in helping the manager to clarify his ideas and in adding to his information regarding his organization. Any manager who has never planned a chart of this kind will be surprised to find how many gaps there are in his knowledge of his own plant. Furthermore, the making of such a chart compels the manager to look upon his organization from the point of view of functions and activities rather than from the standpoint of the persons who are running the business.

This elimination of the personal equation is one of the first things which the manager must accomplish if he would obtain absolute control of his business. He can look at his organization as if it were a machine and, having studied the various parts and their functions, he can take up the question of the personnel and compare the qualifications of the different men who might run that particular part of the organization.

The following chart (Fig. 11) brings out in a graphic way the elements mentioned above. This particular form of organization was taken for various

DEPT. SYMBOLS
 Counting Room COU
 Engineering " ENG
 Drafting " DRA
 Production Depta PRO
 Pattern " PAT
 Carpenter " CAR
 Power " POW
 Forge " FOR
 Press " PRE
 Stores " STO
 Locker Room " LOC
 Die " DIE
 Tool " TOO

CAPITALIZATION
 Bond and Stockholders

NOTE
 The Figure opposite each Name indicates the Reference Number of the Instructions of the Title Holders Duties. These Instructions will be found in the Organization Record.

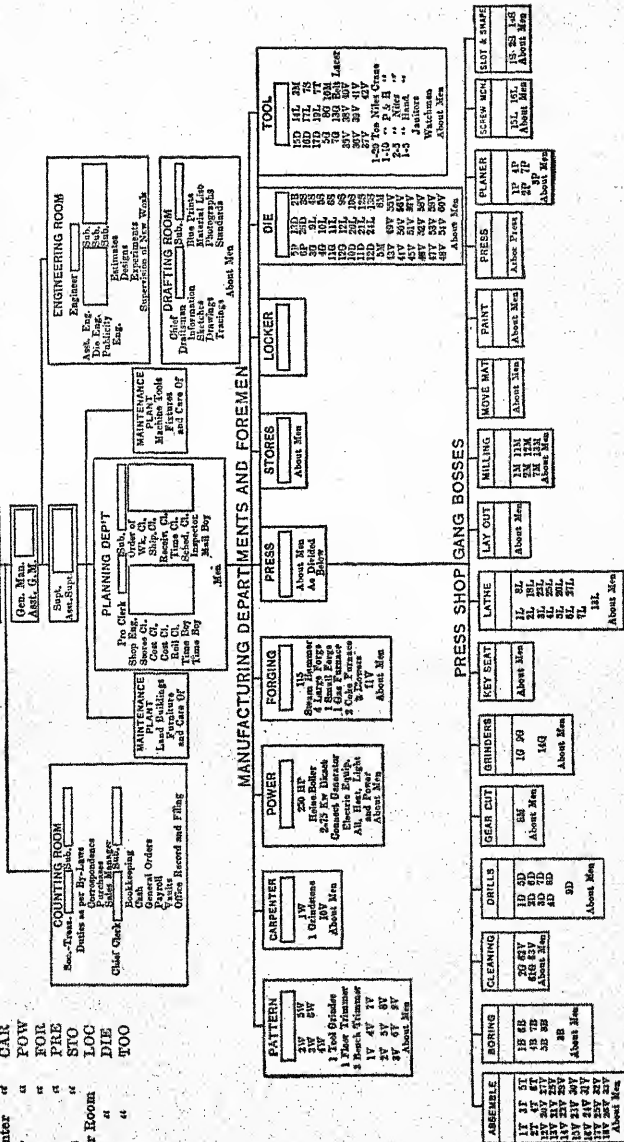


FIGURE 11.—ORGANIZATION CHART OF THE FERREACUTE MACHINE COMPANY. 1
 1 Adapted by permission from Parkhurst's "Applied Method of Scientific Management," p. 8.

reasons. It is a good illustration of that type in which the departmental or functional principle is carried out in a modified way to suit a small industrial plant. Moreover, it shows the position of the planning department in its relation to the other departments.

It will be noticed that on this chart (Fig. 11) the press shop is divided into groups of men and machines. Each group has a gang boss, who is responsible to the press shop foreman. The departments other than the press shop are all small and employ but few men, except the tool room and the die shop. The erecting floor is in charge of the gang boss, under whom are several assistant gang bosses, according to the number of jobs or different kinds of work in process on the floors assigned.

It will be noticed that the planning department is the medium thru which the superintendent controls the shop. All orders, designs, detailed drawings, supervision of new work, etc., emanating from either the counting room or the engineering and drafting rooms, pass thru the superintendent's hands and the planning department before reaching the manufacturing department.

5. *Organization records.*—The organization chart will meet its full possibilities only when it is supplemented by the organization record. It consists of a book of written instructions covering the duties of each person shown on the organization chart. Copies of this record are furnished to each employe or officer concerned. Managers who add this important aid to

their equipment will promote their interests in three ways: (1) writing of instructions prevents the misunderstanding or forgetting of oral orders; (2) writing out instructions generally clarifies the ideas of the men who issue them; (3) writing leaves a permanent record of all instructions which have been issued, often preventing, as a consequence, many confusions and conflicts of authority. Oral instructions leave no written record for future employes. Men who are removed to other departments, or who leave the employment of the firm altogether, often carry with them knowledge of important details which the firm is likely to lose because the foreman, not appreciating the importance of these details in the work, neglects to see that they are recorded. Under a system of proper written instructions, however, this could not occur, for all important details are noted as being a part of the whole operation.

6. *Written records a basis for standards.*—It should be noted here also that a slip of written instructions is absolutely necessary if a manager wishes to adopt one of the further aids mentioned later on, namely, predetermined standards for the accomplishment of his work. If such a record is properly kept up it will furnish the management with a complete account of all the details of the business. It will also contain all the forms from the accounting and other departments, with a full description and explanation of their uses.

It need hardly be mentioned that all changes in the instructions should be written out, copies handed to

the persons affected and a duplicate posted in the organization records. It may not be necessary to record the duties of the manager, but beginning with the assistant manager and continuing on down to the lowest man in the organization, the record should contain written instructions covering the specific duties of each man. These instructions, if compiled in book form, would make a goodly volume, and the collection of the data requires much time and labor. After the information is gathered it has to be continually revised. These are the objections generally offered against adopting such a record as an aid to the manager. If all this information which is floating about in the possession of the employes, unknown to the manager, is vitally essential to the accomplishment of the work, then it is well worth while to have it put down in writing even tho the process does require much labor and money.

7. *Lack of control causes confusion.*—One of the commonest sights in the ordinary machine shop is men running here and there looking for tools, materials or seeking further instructions. To a greater or less extent this lack of system is found in every business which has not adopted some method of routing material or tools to the mechanic and supplies to the clerks and operators, whereby they may be supplied with everything necessary to carry out their work. Such a condition denotes a lack of strict supervision. This situation has grown up largely because industries have increased so in size; that is, business

enterprises have added to their equipment and to their labor forces, while, on the other hand, they have not had a correspondingly large extension in the departments of management and administration.

8. *A typical example of nonproductive labor.*—A machine shop, for instance, employing a superintendent and a foreman would be called upon to supervise the efforts of 125 men or more. They are perhaps given clerical assistance to the extent of two or three clerks; and such a situation might be considered an ideal one by many managers. The so-called nonproductive labor has been reduced to the minimum. Such managers, however, lose sight of the fact that the brain energy—namely, the planning which must accompany every operation—forms the greatest part of the work. It is the same old story again of making the brain save the heels; and in an office, shop or factory, when the heels of the employes are working, generally some machine or other important costly device is being left unused, and the output is being restricted by the unproductive activity of both men and machine. A flock of “order chasers” running thru a plant is a sure sign that there is little direct supervision or centralized control of the productive process.

The motto of many business executives seems to be: “Millions for machines and expert machinists, but not one cent for supervision.” Money spent for men who would plan the work before it enters the operating department is looked upon as tribute. It appears that one of the best aids in overcoming the handicap im-

posed upon the manager by the extensive operations which must be carried on under modern business conditions, is the establishment and maintenance of a planning department.

9. *Planning is specialized management.*—Planning is carrying into the supervising activities the idea of specialization, which has been operating in the production side of our industries for the last hundred years. Specially trained men must plan and analyze all the work, methods, etc., and prepare the way for the workman to produce at his highest efficiency. The workman is skilled in his trade; he is a specialist. The man in the planning department is skilled in analysis, and he also is a specialist. The duty of the planning department is to find "the one best way" for doing a thing before a cent has been spent in either labor or material. It designs the job, prepares proper details and drawings, analyzes the work in its various elements, and routes it in its future progress thru the office, store or shop. It is easily seen that when this is done the greatest part of the work has been accomplished, for planning means brain work. The savings made after the introduction of such a department are not always of the spectacular kind, such as were effected when the new tool steels were first introduced; nevertheless the gains are important even tho they are made up of innumerable small savings.

10. *Planning and overhead expense.*—The chief objection offered by many managers to the introduction of the planning department is the added overhead ex-

pense. They look upon all planning expense as non-productive, and when it means that there shall be one man for the planning department for every three to five men in the operating department the proposition appeals to them as absurd. Besides this, the outlay for printed forms and office supplies is largely increased. But before judgment is passed it is well to look at the results. If the total net cost is not increased it makes little difference whether the money is spent on producers or on the so-called nonproducers. In the case presented by Mr. Hathaway the total number of men employed under the new system is not more than that employed under the old system. They were simply distributed differently. Under the old system he employed 125 men in the operating end and two clerks in the office. With the planning department added, he now has 100 men in the shop and 25 in the planning room.

11. *Overhead actually reduced per unit.*—The overhead charges naturally increased but they were far from being "nonproductive." The product turned out was three times what it was before this new aid to the management was added. Such an outcome simply puts the addition of a planning department on the basis of any other investment. It is in reality spending money looking to future increased returns. Mr. Parkhurst claimed that for a shop employing a few hundred men, only about six additional employees in the new planning department were necessary. The cost for the six additional men, in wages,

totaled about \$4,000 a year. For additional stationery, office room, etc., this sum was increased by \$1,000. But this change brought about a doubling of output, not to mention the permanent assistance obtained by the manager thru having at hand a force of men investigating, collecting and utilizing knowledge which he could not possibly get unaided.

12. *Evolution of the planning department.*—The organization of the planning department is a natural evolution of much interest to the student of management. Under the traditional system of management the foreman and workingmen, after deciding in a general way what the work was, put the job into the shop and studied how, when and where it was to be done after the operation had been set in motion. It is perfectly evident to most managers today that it is not safe to trust the planning of what is to be done to the men who are to supervise the execution of the work. But it took many years before the establishment of the drafting department was considered anything else than an extra expense or burden. Just as the planning of what was to be done before the work is put into the shop was found to be even more economical when put into the hands of experts, so it will be found that there will be even greater savings when the planning of how, when and where the work shall be done is taken from the shoulders of the foreman and the men in the shop, and is put in a special department called the planning department. It will be seen at once, therefore, that nothing is done in the

planning department that does not have to be done by someone in the place, under any scheme of management. Some workmen are good at planning their work, but others are not. Thus, it appears that if the best man in this respect is selected for the planning, all the less efficient men will get the advantage of his greater sagacity.

13. *Thoughtful plans make valuable records.*—Not long after such a man is put in full charge it is found that the advantage gained is not alone that resulting from his superior intelligence. The company soon accumulates classified and recorded data which become a source of knowledge in planning the best methods, greater than that furnished by any individual man's experience.

14. *Planning movements and operations.*—It is easy to show the advantage of planning ahead in order to provide necessary materials, tools and supplies, but to make men see that it is just as necessary to plan the movements, operations, etc., ahead is more difficult. Where this has been done, however, further subdivisions of the work of the planning department are necessary. This work is of two general kinds, planning *how* each job is to be done, and planning *when* it is to be done. Concerned with the *how* are the following specialists: route clerks, instruction-card men and time-study men. Concerned with the *when* are the production clerks and the order-of-work clerks. It was soon found, however, in shops making a diversified product that still further subdivision of

the work in the planning department must be made. Accordingly, we find such men as recording clerks, balance-of-stores clerks, foundry clerks, clerks who write up the numerous details, make out orders, tags, etc., time-keeping and cost-keeping clerks, and various others.

15. *Proportion of planners to doers.*—The question of how many of these men will be needed in the planning department depends entirely on the nature of the specific business. Some businesses will require two or more men for each of the positions, whereas in others two or more of the functions may be put under the direction of one man. In one shop, for instance, employing several hundred men, four clerks in the planning department handle all the work, while in another concern, employing only about one hundred men, twenty-five clerks are necessary. The first concern manufactures a limited variety of products in large quantities from standard designs; the second concern manufactures a great variety of goods in small quantities, and with frequent necessary changes in their design. In the first case a man at a machine may run on the same job or on similar jobs for a month, whereas in the second concern each workman is employed on three or four different jobs every day. It will be seen at once, therefore, that a description of any one planning department will be incomplete, but for our purpose it is best to take the more complex form, where the duties of the various men have been clearly differentiated and put into the hands

of individual persons. This will make the explanation simpler and more comprehensible, since each function, in such a scheme, will have an individual man to carry it out.

Perhaps the organization of the department can be most easily understood if we take up the duties of each clerk as they arise in planning for a manufacturing order. Each man in turn will receive this order and work out the plans which come under his jurisdiction.

REVIEW

An employe suggests to his superior officer a plan which involves extensive changes in the organization. The suggestion is "turned down" without comment. What allowance should the employe make for the officer's attitude?

Would an organization chart help an employe who wished to present to his chief plans for the improvement of his department?

What is meant by organization records?

It is conceded by experts in organization that a planning department increases the amount of clerical help necessary to carry out the work along the lines laid down by scientific management. What argument will offset the one implied in the above statement, namely, that overhead expenses are unduly augmented?

Is a planning department an absolute innovation in the factory or office?

CHAPTER XII

PLANNING PRODUCTION—THE FACTORY

1. *Planning department of a factory.*—In choosing an example to show the methods followed in the planning department of a factory we may select an engineering enterprise. Here the work is more minutely subdivided than in other enterprises and affords better opportunity to study the detail of the planning organization. In such a concern we find the following positions: (1) production clerk, (2) route clerk, (3) foundry clerk, (4) balance-of-stores clerk, (5) instruction-card clerk, (6) route-file clerk, (7) order-of-work clerk, (8) recording clerk, (9) mail carrier, (10) tickler clerk, (11) time-and-cost clerk, (12) stenographers, messengers, etc.¹

2. *Coordinating duties of production clerk.*—As soon as the process of specialization has divided the duties of one man or of one department among several men or several departments the chief problem of management is to bring about an efficient cooperation among the various parts which have thus been separated. When an enterprise grows to anything like normal proportions, it is necessary

¹ It must not be assumed, however, that this sequence is absolutely necessary. There are cases where several of these functions may be performed at the same time; that is, two or more of these clerks may be working out their plans at the same time.

to separate the sales department from the manufacturing department. No sooner is this division made, however, than difficulties arise. The sales department sends in orders and expects the manufacturing department to get them out on schedule time. As every business man knows, these expectations are not uniformly realized, and friction results. A reduction of this friction and the bringing about of a greater amount of cooperation between these two departments is one of the chief functions of the production clerk. He is in a true sense a coordinator, the connecting link between the sales force and the shop. The sales department depends upon him for information upon which to base its promises of delivery. He is, in fact, responsible to the sales department for making these deliveries at the time promised.

3. *Setting sales-delivery dates.*—To set his dates, however, the production clerk must have information other than that supplied by the sales department. He therefore first consults the stores clerk and learns what manufactured articles are required for stock. With this in mind he then sets to work to prepare a schedule, or, as it is called, an order of work. This schedule contains a list of all orders in hand for each department, arranged according to their relative importance. The importance of an order is, of course, determined by many conditions, but in general the classes into which most of the manufacturing orders may fall are as follows: (1) the emergency work, (2) tools or appliances, (3) manufacturing orders,

(4) orders for stock parts, (5) orders for stock machines. As soon as an order comes to the production clerk, he classifies it under one of the above divisions.

4. *Relative importance of orders.*—It need hardly be said that the emergency job has the right of way thru the factory in preference to any other job. But the production clerk must consult the manager before an order can be placed under the emergency class. An order in class 2 would have preference over any orders of the later classes, for such an order would arise only when the work under way was being held up because of a broken tool or a lack of appliances, etc. Class 3 comprises all those orders for products not carried in stock, but which must be made up after the customer's order has been received. This class may be further subdivided into definitely dated orders and orders which can run on and be completed at the manufacturer's convenience.

At regular intervals whenever the need arises the production clerk revises the order of work for each department.

5. *Further duties of production clerk.*—The schedule having been made out, the production clerk must see that its requirements are observed in the drafting room, in the planning department itself and in the shop. In fact, his duties now are largely those of "checking up." Having fixed a date for the completion of the job, and having placed the date on the shipping order, he files the memorandum away in the tickler. When the date arrives for this job to be

started, his record appears automatically and he checks up the drafting department by it. A like method is pursued in checking up the planning and the delivery of materials. The tickler is to the production clerk what a cab window is to an engineer on a locomotive; both men must be constantly looking ahead to assure themselves that the track is clear. If obstructions appear the production clerk must arrange to have them removed in plenty of time so that they may not interfere with the general order of production.

6. *Aids that lighten the production clerk's task.*— In watching the progress of the work thru the shop, the production clerk has further aids to help him in detecting things that go wrong or that may go wrong. These are the route sheet, the progress sheet and the bulletin board. The method by which the production clerk checks up the progress of the work in the shop is interesting because it differs so widely from the practice in common use. His mind is continually on the promise he has made to the sales department, that upon a certain date a certain delivery will be made. He therefore begins his daily checking up of the progress of work not by first looking up the orders due to be shipped today, or those overdue, but, on the contrary, by starting at the bottom of the list and making sure that everything necessary to the completion of the order just received is on time and is being carried out to the letter. He works up the list instead of down, and the last item to receive his atten-

tion is the order which is to be shipped immediately. Mr. H. K. Hathaway, in the *Engineering Digest* for July, 1912, says:

The principal cause of the failure to complete orders on time is that little or no attention is given them on this score until the date of shipment approaches. In machine shops a great deal of time is ordinarily wasted in getting drawings and patterns made, and getting materials into the shop. This time cannot be made up after the work is started, and the effort to do so results in confusion, decreases the efficiency of the plant, and causes more or less friction among the individuals comprising the organization.

7. *Qualifications for the head of this department.*—The production clerk need not necessarily be a man trained in the technic of the particular business which he serves; if he is in the planning department of an engineering concern, however, it will be much to his advantage, and add to his efficiency, if he has had two or three years' shop-practice experience. Of course, he must be familiar with the processes of manufacturing, for these determine *when* a certain operation is to be done. It may also be well to mention here that the authority of the production clerk, like that of all other members of this department, is supreme in his own field. Even the manager or superintendent must respect his authority. But when he has planned the time when certain work shall be done, his authority ceases. Beyond this he has no right to say what shall be done or how it shall be done.

8. *Route clerk.*—The function of the route clerk is to show *how* a thing is to be done. As soon as the

drafting department has shown what is to be done, the planning of the work proceeds to the route clerk. It is his duty to take the information which comes to him in the form of drawings and bills of materials and plan *how* the product shall be made. He must be able to read readily the drawings from the drafting department; he must understand machine construction, so as to be able to analyze it and put in writing or in chart form the methods which show how the manufacture is to be carried out in the shop. Furthermore, he must be thoroly familiar with the location and capacity of all the machines, so that his routing of the material may be the most efficient possible.

9. *Method of work for the route clerk.*—In preparing his outline or his diagram, the route clerk proceeds about as follows: (1) Having analyzed the construction of the machine he divides it up into groups or parts. (2) He studies the length of time it will require to get the castings or various parts that call for special construction, and the amount of time necessary to work up the various parts and assemble them. Knowledge of these points enables him to decide the relative importance of the various groups, and with this scale or order of importance in mind he is enabled to lay out the first draft of his chart or diagram which embraces only the individual groups. (3) Each group is now considered separately and a special diagram or route chart is made of it. This will include, in their order of relative importance, all parts that go into the order, the operations to be per-

formed upon them, the machines that are to perform the various operations and the material required for each part, with a note whether it is to be purchased from the outside, made especially for the job, or to come from stores. (4) He applies to each part a suitable symbol. This identifies the part as it goes thru the shop, indicates what part of the machine it belongs to, and serves as an operation order-number and an index to the instruction card which is made out for the several operations. In fact, this symbol is used in connection with all the processes involved in the manufacture and planning of this job, at length serving the cost keeper in compiling his records, and finally becoming a basis for filing any data which may pertain to the piece that the symbol represents. (5) Under instructions from the route clerk, another clerk prepares route sheets and progress sheets upon which the movement of the work thru the shop is recorded. In fact, it is here that the various operation orders, inspection orders, stores issues, etc., originate.

The work of the route clerk in a large plant becomes very involved, and requires that the duties of the office be subdivided. Thus there will often be found one expert who gives his whole time to the making of route charts pertaining to the assembling alone. Other experts will be engaged solely in laying out the machine operations for the various parts; others again will compute the quantities of material required, and the like.

10. *Qualifications of route clerk.*—Any man who

is put in a position where he must show other men how things are to be done, should be endowed with much tact. Especially is this true of the route clerk, who must consult daily with the foremen in the shop, seeking their advice as to the best method to be followed in machining various parts and assembling them into groups, etc. Even in the planning room itself he must be in continual conference with the various clerks of the department. It is the time-study and instruction-card men who can tell him which machines and what laborers can perform the work in the most economical manner, whereas the balance-of-stores clerk can inform him of the condition of the material and supplies.

11. *Special-material (foundry) clerk.*—Concerns that do a variety of work and do not keep all the materials on hand, find it necessary to order the special material from outside. In cases where this is done continually, a clerk is provided to look after the special work in the planning department. He is frequently called the special-material clerk, but in machine shops where the special material referred to is largely made up of castings which must be obtained from some outside foundry, he is spoken of as the foundry clerk.

12. *Duties of foundry clerk.*—The foundry clerk's duties do not call for a man trained in the technic of the manufacturing business, but they do require a man who is wide-awake; because special work of this kind, especially if it is in connection with the foundry, in-

volves the care of a great number of patterns. The first duty then of the special-material clerk is to see that the patterns are stored and labeled properly. He must know whether they are in storage or whether they are at the foundry. The records will show when patterns were delivered and when returned. His next general duty is to make out detailed orders on the foundry, and these orders it is his further duty to follow up closely. Each order, therefore, is carefully scheduled; it shows the amount wanted, when wanted and the number in each lot. It has been found that the checking up of these lots when they are delivered from the foundry is a very important thing, since the foundry must deliver the full number in each lot if the job is to be complete before any order is begun.

Anyone familiar with the common shop methods, where special materials are often delivered in broken lots, will easily see where such a foundry clerk will soon earn his salary. Without him, jobs are started when only a part of the material is on hand, only to be dropped again when the supplies run out. This often requires the machine to lie idle for a long time or to be reset. Altho this position is purely a clerical one, it requires much energy, because the clerk must see that material is in the shop on time.

13. *Balance-of-stores clerk, a unique feature.*—The taking of the "stores balance sheets" out of the store-room and putting them into the planning department is one of the unique features of the planning depart-

ment. The clerk who has charge of this department is called the balance-of-stores clerk. His chief duty is to keep a running inventory of each article carried in stock. His records are kept on what are known as "balance sheets." The chief items which this clerk must look after are indicated on the sample sheet (Fig. 12) on page 162. In brief they are: (1) the maximum and the minimum quantity, (2) the actual quantity carried in the stores, (3) the quantity on order but not yet received in stores, (4) the quantity required for orders for shipment or manufacture to which they have been apportioned but not yet issued, (5) the quantity available for future requirement.

14. *Major and minor duties of balance-of-stores clerk.*—The detailed duties of the balance-of-stores clerk will be indicated by these items themselves. He will have various forms to make out, such as orders on the storeroom as soon as the route clerk hands to him his route chart and bill of materials. Altho these duties are largely those of a bookkeeper, nevertheless there are others, such as checking the balance sheet against the actual stores, which call for considerable expertness in the classification of the various orders according to their symbols, since the stores orders are returned to the balance-of-stores clerk at the end of each day by the storeroom clerk.

Of course it is this clerk's duty to inform the production clerk as soon as the supply of stock parts begins to run low; and in case any of the materials are not available at the time of the apportionment, he

[illegible]

must also notify the proper authority in the planning department when the material arrives, so that orders may be issued for the work to be started.

15. *Time-study clerk.*—Since the function of time-studies will be taken up later, it will not be necessary to say more here about the duties of the time-study clerk except that he must make such elementary time-studies as are necessary in determining the best methods to be followed in the performance of each class of work.

16. *Instruction-card clerk.*—The man who holds the position of instruction-card clerk should have a high appreciation of the importance of detail. This office is often combined with that of the time clerk because so much of the work of the instruction-card clerk depends upon knowledge obtained from the time-study. His duty, clearly indicated by his title, is to prepare instruction cards showing the method to be followed in the performance of each operation, what tools are to be used, in what sequence the operations should be performed, the time to be taken for each operation, etc.

17. *Route-file clerk.*—When the route clerk has finished his sheet and diagram, he passes them over to the route-file clerk, whose duty it is to transfer the information from these route sheets to suitably sized slips of paper, tags, etc., whereby the route clerk's information can be carried to the storeroom, the shop and the various other places connected with the performance of the work. For example, there will be

an order on the storeroom for material from which the article is to be made, a tag to be attached to the lot or part, an order for each operation, for the inspection that takes place at the start of each operation, for the inspection of the work when it is completed on the lot, and for moving the materials from one place to another.

These forms are made out for each unit into which the work has been divided by the route clerk. An envelop sheet, bearing its appropriate symbol whereby it can be easily recognized, is then prepared. In this are placed the operation orders, etc., pertaining to that unit. The envelop sheet is then filed for the use of the record clerk, whose work begins as soon as the work on this job starts.

18. *Order-of-work clerk.*—Altho the route clerk has already shown how and where the work is to be done, nevertheless it requires another man to administer the order of work to the employes in the shop; the medium which he uses is the bulletin board.

As soon as the job is ready to be put into the shop, the record file is taken from its place and the various operation orders are removed and placed in the possession of the order-of-work clerk. Being thoroly familiar with the work of the plant, he knows the capacity of both men and machines. He sees that the various jobs ahead of each machine are taken up and performed in accordance with their relative importance. In deciding this he is, of course, guided by the schedule furnished him by the production clerk,

already mentioned. On the bulletin board, therefore, will be displayed notice of each job and of the machine to which it is assigned. Furthermore, it can be seen at once whether the job is being worked upon, whether it is to be done next, as soon as the job under way has been finished, or whether it stands further down on the list.

Besides having a good memory, this clerk must also be endowed with considerable tact, since he must secure much of his information from the various foremen and inspectors in the shop. Thru his contact with them he keeps continually informed as to the best workmen and the capabilities of the various machines, as well as to the grades of work which each is capable of performing.

19. *The eye of the superintendent.*—Without going into the shop, therefore, the superintendent can see in advance what machines and what men are occupied. If for any reason the order-of-work clerk does not find work for some of the men, he must at once notify the superintendent or whoever is the proper person. It will also be his duty to inform the proper authority in case there are not enough men to handle the work which is already on the floor or which is planned for some particular period. The bulletin board referred to is the most important device in the planning department; it will be described later, when the routing of an order thru the shop is taken up.

The order-of-work clerk is a very active person.

He must continually and systematically go over his bulletin board. He must permit neither man nor machine to run short of work if it can be provided, nor must he permit an important job to stand waiting while one that is less important is being worked upon. The great economy effected by the bulletin board is the saving of the time generally lost between the completion of one job and the starting of the next, the rule being to have preparations made in the plant for two or more jobs ahead for each workman.

20. *The recording clerk.*—On the route sheet, each step in the progress of the work to be done on a lot or part is indicated, so that what has been done and what remains to be done is always evident. Each step and the time it is to be taken are clearly indicated. Along with this information, which has been filed in the envelop sheet by the route-file clerk, comes also other important information, such as the tool list, instruction cards, designs, etc. Upon the information thus provided the record clerk performs his functions, which are mainly to record the progress of the work, to issue and receive operation orders, inspection orders, move orders, etc., at each phase in the progress of the work.

21. *The cost clerk.*—The cost clerk is held responsible for all cost records. A system of management which employs a planning department uses its cost records for two purposes: (1) for keeping the records of the work which has been done during various periods of the past; (2) to show the condition of the

work at any particular period when a report is called for by the manager. The operation orders, and other slips which are used in the administration of the operations in the shop, etc., at length become the basis on which the work of the record clerk rests. As a job is finished, these slips recording the workingman's time, his rate of pay, his bonus, etc., come directly to the cost clerk.

22. *How cost sheets are kept up to date.*—Thus all cost sheets are kept up to date. All labor and other charges to the job, at the close of work each night, must be posted on sheets up to and including the progress of the day previous. The division of the cost clerk's work, mentioned above, forms the basis for a further duty, namely, managing the cost files. These files are of two kinds: (1) the live file; (2) the dead file. Only work in process must remain in the live file. When work is completed, ready to be shipped, or the job is otherwise closed, the slips are removed from the file as soon as the cost clerk is satisfied that all charges that belong to them are posted. They are then put in the dead files and stand as records for future reference.

The cost clerk generally has an assistant who figures up the payroll and makes out the bonus rewards, etc. The cost records kept under a system of this kind are very simple. All materials, requisitions from stores or from outside places, all time expended in the shop, either as expense or as work in process, will be posted on the cost sheet. A second sheet, known as

the distribution-sheet, will then show all the time as it is distributed daily.

23. *Duties of cost clerk.*—To describe the full duties of the cost clerk would take us too far into the field of accounting. A brief summary of his duties, as laid down in the book of instructions of one large company, will suffice:

The cost clerk should make it a point to close daily all cost sheets for work completed, after being sure that all the charges for these jobs have been received and posted by them. This cost includes material, labor and sundries which, totaled, represent time cost. To this opposite expense must be added the prevailing overhead burden per hour. This burden, added to the time costs, represents the total manufacturing costs. Differential burden or machine hour is posted in each labor-operation column. Each month the cost clerk must make a report to the general manager.

24. *Timekeeper.*—The first duty of the time clerk is to regulate all the clocks in the shop. The time-clocks on which the men register as they go in and out, he is required to watch closely. Each day the clock cards are checked up and totaled, the total being checked against the individual time-card for each man and turned in by him or the gang boss or foreman each day. This insures the proper distribution of the exact amount of time, which is shown by the time-clock card, and for which the men will be paid. This time is totaled daily and distributed upon the distribution-sheet mentioned above in connection with the cost clerk's duties. This, of course, must agree with the cost clerk's entries.

25. *Planning introduces no new duties.*—It was not intended in the foregoing description of the various duties performed in the planning department, to describe all the activities that might possibly be included in a planning department. The description, however, will serve to show that there are no new duties or functions carried out in the planning department which have not previously been carried on in the shop. Those duties which could be easily separated from the purely operative functions have been put by themselves. One important feature of this form of management is that the workmen have absolutely no clerical work whatsoever to do and it is not necessary that they touch a pencil or time-stamp, from the time they arrive at work in the morning until they stop at night. As L. M. Gilbreth says in a paper in *Industrial Engineering*:

Master planning is the last study. The best planner is he who—other things being equal—is the most ingenious, the most experienced and the best observer.

The art of observing is founded upon a study of the mental element. In order that planning may be done best, the entire sequence of operations must be laid out previous to starting the work, so that the ideas and values of every element of every subdivision of the process of work may be corrected to act most efficiently in relation with each and all of the subsequent parts and events that are to follow. This planning forward and backward demands an equipment of time-study and motion-study records such as can be used economically only when all the planning is done in one place, with one set of records. The planner must be able to see and control the whole problem in all of its aspects.

26. *Other functions associated with planning department.*—The duties of the disciplinarian, gang boss, speed boss, repair boss and inspector have not been touched upon here. Altho these men may be put into the planning department, they are more closely allied with the "performing department." The planning department, then, in contrast with the performing department, classifies its work under seven general functions, namely, (1) what is to be done, (2) the sequence in which it is to be done, (3) the method by which it shall be done, (4) which men shall do it, (5) the time that it will take, (6) the exact quality of product, (7) the amount of additional pay that will be given for doing it. The workers are given standard tasks to do. They have teachers to help them, and as a reward they are given a standard wage according to the performance. The management, knowing what the planning department is expected to do, is also in full possession of facts as to just what the men in the shop are expected to do. The workers are expected: (1) to give their cooperation in carrying out prescribed work, method and quality; (2) to exercise their ingenuity in making improvements after they have learned the standard prescribed practice; (3) to fit themselves for higher pay and promotion.

REVIEW

How can a planning department in a factory aid the sales department in keeping delivery dates?

What training or preparation would be necessary, in your estimation, to fit a man to become a production clerk?

Which clerks in the planning department are least necessary in the operation of the plant?

What conditions involved in manufacturing make it desirable to introduce planning departments into factories?

CHAPTER XIII

PLANNING THE CLERICAL WORK

1. *Office systems often haphazard.*—Every office is started with a plan; but business undertakings, if they prove successful, are likely to grow rapidly, necessitating a rapid expansion of the office. Sooner or later the office system breaks under the strain, and again the work of the office is planned. This second planning is usually spoken of as a “reorganization,” since several old employees lose their positions, a few new partitions are run up, a new filing system is adopted, and so on. Again the planning ceases and the office goes on its way until a new catastrophe calls attention to “needed improvements.” Thus most offices today are made up of accretions of clerks, machines, desks and departments to which very little attention has been given so far as a studied division of the work is concerned.

A few years ago it was generally thought that all the ills of office administration could be cured by additions of new machines, or a new “system,” but as the size of the business increased, the number and variety of machines and the complexity of the systems became problems in themselves. To solve these problems “systematizers” were engaged to straighten out

the tangled mass of activities and equipment. As in the case of most betterment movements of this kind, the investigators began at the wrong end by trying to adjust some special system to new conditions without a thoro study of the local requirements; or else they made an equally grievous blunder in supposing that the system when once installed would run of itself. It did not take long for "system" in both England and America to become associated with "faddism" and quackery.

Here and there, however, a large insurance company, a bank or a big mail-order house began to study its office problems scientifically. By such study, the Metropolitan Life Insurance Company discovered that a contract could be handled in two or three hours instead of as many days. The Fourth National Bank of New York made similar reductions in the time necessary to handle the checks coming in thru the mail. And the National Cloak and Suit Company by means of a series of time-studies was able to route its orders thru the office on a regular time-schedule permitting orders to be attended to the same day they are received. But systems such as these require constant attention. Spasmodic planning is not enough.

2. *Working toward functional control in the office.*—To provide for the constant changes which are taking place, some of the larger companies employ an office manager whose sole duty is to watch and plan the office work. He may be given assistants, but the scheme does not provide for a regular department

where planning is the chief function; the idea that the manager is the "boss" is a minor consideration. Other companies attempt to modify this purely military form of office organization by introducing some form of the suggestion system. But here again the responsibility for definite and continuous planning is lacking, and the only contribution in this direction offered by the suggestion box is a series of spasmodic suggestions—sometimes called "constructive" because the manager has given so little attention to the real nature of his office that everything which emerges above the mediocrity of daily routine "looks good" to him.

Still other concerns move a step further in the direction of functional control by adopting some form of the committee system of management. But here, as in the suggestion system, the watching and study necessary to correct the organization perspective is lacking. The committee system has its peculiar merits but it cannot take the place of careful, thoughtful planning.

3. *Planning department for the office.*—The most recent development in the field of office management is the planning department. This development is in line with a similar movement for a more refined specialization in administration and a closer control of functional activities in factory and shop.

The progress of this movement presents an interesting study. Here we see displayed the same attitude of mind on the part of the administrative officers

as in the case of the planning department in the factory. Each man is inclined to say that the logic supporting the argument for a planning department is good but applies to the "other fellow," for "my business is different." But while this attitude is evident among managers of large businesses, they never persist in it so long as the managers of small businesses. It is the small manager who first refuses to entertain new ideas, with the argument that "my business is different," and then after being driven from this defense, settles down into his trenches behind the plea that only a large business can afford the luxury of a "thinking" department; and from this position the small man is seldom driven out. But there is a difference between holding a position and being buried in it.

4. *New policies involve new methods.*—When the equipment of an office was made up of quill pens, a high desk and a stool, the administration of an office consisted largely in the distribution of work among the employes. But a modern office, besides being larger, has many new duties connected with its operation. The purchase, installation and care of the office machinery is almost an art in itself, to say nothing of the constant watchfulness necessary to discover new and better methods while guarding against the countless importunities of salesmen with new but unproved devices and systems.

But while the problems pertaining to the mechanical side of the office control have grown, the human element presents problems never dreamed of a few

decades ago. The old type of office manager, who based his control on *ire* and summed up his two functions by adding "h" to *ire* when he wanted a new employe and "f" to *ire* when he wanted to get rid of him, is very different from the modern manager; the latter must have something more than temper for his administrative equipment. Corporations and other business organizations have now generally accepted as a part of their plans the training and guiding of their employes, as well as the careful selection of them—all of which involves studied methods for increasing efficiency thru better physical, mental and moral surroundings. Office management, therefore, has grown in importance in just the proportion in which cooperation has superseded exploitation in administrative policies.

5. *Function I: Keeping the organization in order.*—Most businesses, no matter how progressive, present opportunities for improvement. Rapid growth generates maladjustments in the organization. Especially is this true of the office. Therefore the first function of the planning department pertains to the solution of problems connected with the office as an organization. If we presuppose a standard of organization and procedure which all employes are expected to know and observe, the first duties of the planning department would be to provide a systematic means of keeping in touch with all technical changes in the organization and all departures from standard practice. This requires the

planning department to be in touch with the whole office organization, so that its recommendations and decisions may achieve the greatest good for the organization as a whole. Thus, the planning department would receive information from individual departments and would offer its recommendations, based on first-hand *contact* with all departments, to the head of any individual department. Even if the functions of the planning department did not go further than those matters pertaining to organization, much aid could be rendered individual heads of departments by placing at their disposal all the accumulated experience which would come to this central department. For, besides the duty of collecting information from within its own organization, it would also make a special effort to study the methods and policies of other concerns. A second organization duty would consist in keeping the lines of authority clearly marked out between the various departments. Weak but aggressive men often step over the boundaries of their provinces and attempt to annex new duties which do not belong to them; while passive men not only permit these aggressions but allow their own administrative methods to become immersed in a mass of detail which cuts them off from functioning as an organic part of the organization as a whole. A third function in connection with organization is the constant watching for departures from prescribed procedure. The subtlest evil of every system is the tendency of the individual to depart from the scheme of organization as it is laid

down. The individual loses sight of the relation that his activity bears to the organization as a whole and slights certain duties which may cost him an outlay of energy or at least impose some discomfort.

A planning department which performed its duty would keep the organization in constant working trim; lines of authority and functional activities would be kept clear between officers and departments, and thus the confusion would be obviated that comes from the duplication of work and from the departmental friction which arises where these lines are blurred.

6. *Function II: Development of methods.*—The office, like the factory, continually presents new problems. Methods must be changed to suit exacting conditions. This is not a valid excuse, however, for not adopting some system of standardization. While departments differ from one another in some respects, there are always a number of functions which are common to many or all departments. Standardization is the reduction of these activities to a common method of performance, and much is gained in the way of efficiency thru such a method.

To provide for improvement in methods as well as to be prepared for changes, the office procedure should be written up in the same way as the routine in the shop and factory. The argument for this procedure is the same as that given for the establishing of records in factory administration. Thus, the planning department by being continually on the alert can keep the records up to date by making changes, giving due

consideration to every department which is affected and seeing to it that these standard instructions are lived up to by every department and every person in each department.

7. *The office records.*—The three prime records of the office, from the planning department's point of view, are the office manual, the special data book and the desk record of instructions. It is easy to recognize the counterparts of these in the factory.

The office manual is the final authority in office organization matters. Herein is described the character of the employment in each department. Its chief contribution from the operative-efficiency point of view lies in the time it saves by placing in the employes' hands an authoritative source of information; it obviates the necessity for the executive to take up time and energy in explaining things which have already been decided upon. On the other hand, it furnishes the executive detailed data with reference to his organization; this information is valuable to him as an administrative aid in the adjustment of salaries and promotions pertaining to the class of work each employe performs.

In order that the records may be kept up to date, the data in the office manual must be supplemented by records which show the decisions covering general routine from day to day; these records in some way modify the procedure laid down in the standardized instructions of the manual. This book of memoranda is known as the special data book, and since every de-

partment must keep one as a record of the particular legislation issued by the executive authority, much confusion can be avoided by checking individual departmental orders which would run at cross purposes with those of other departments.

The third set of records consists of the individual instruction cards. As the work of specialization goes on in both factory and office, the greater becomes the necessity of clearly defining the duties and describing the activities of the various production units, whether each unit be a department, a machine, a work bench or an office desk. In the work of standardizing the office, the desk is coming to be recognized as the unit about which certain functions cluster rather than a place where certain individuals work. Accordingly each desk is equipped with a set of instruction cards describing, under subject headings and appropriate subdivisions, the work to be done. As used by the Retail Credit Company of Atlanta, Georgia, these cards are 3 x 5 inches in size, and each clerk carries in a tickler a set pertaining to his desk. When work is even temporarily rearranged, the tickler is placed upon the desk to which the new functions have been transferred. This method standardizes the work of each desk and of each clerk. The cards are especially valuable in aiding new employes to master their duties, and in furnishing a record of absentees and the work of substitutes during vacations.

It is apparent that specialization of this kind tends to break down the coordination which exists when

one man performs many functions. The coordinating element here is the man himself. When these functions are distributed among several men, it is necessary to supply administrative coordination. Thus, in preparing and improving the records and instructions, and in delegating duties, a planning department supplies the needed coordination, since these matters become the special care of a department which looks upon the control of office duties as a service to the whole organization.

8. *Function III: Development of standardization.*—The part that standardization plays in modern business administration is considered in Chapter XIV. We limit its application in the office to the methods, materials and equipment used. One of the chief influences which made a careful study of standardization in the office a necessity, is the need of utilizing space more efficiently. Accordingly, filing cabinets, book and card records, stationery, etc., have gradually grown smaller, with the attendant necessity of shortening phraseology, of the development of symbols, and arranging printed matter to meet the space conditions. A planning department, by keeping on file samples of all the forms used thruout the organization, could give valuable suggestions and could direct with intelligence the development of a policy which would work toward a general standardization of forms and equipment thruout the office.

With respect to the development of standardized equipment, the planning department can play a very

important part. In the factory, the planning department contains a testing division whose duty it is to examine machines, product and materials in accordance with standard specifications of quality, etc. The office today, thru its use of mechanical aids, is undergoing a like development. The purchasing department may provide men who are experts in buying according to specifications of quality, etc.; their work needs to be supplemented, however, by the judgment of experts upon the utilization of the machines and materials. The planning department of the office should, therefore, act as judge in such matters. Take the choice of a desk as one example. The planning department, by its study of the uses to which the desk is to be put, can decide between the flat-top, the standing desk and the "tub" type, with better results than a purchasing department, which judges purchases on the basis of prices. Desk standardization brings many economies, such as savings in the stationery and desk supplies; and if we consider its importance in the dispatching of work, as, for instance, in the case of the National Cloak and Suit Company offices, a very wide range of activities is opened up for the consideration of the planning department.

If we carry this function of the department a step further, we find that it also naturally embraces the study of the equipment market in order to keep the home office informed as to all new and meritorious labor-saving devices. Its representatives should know what is offered thru the latest circulars and

catalogs, and should keep in touch with "business shows," expositions and the experiences of their competitors.

9. *Function IV: Development of betterment plans.*—Just as the function of discipline in the shop is taken away from the shop boss and placed under the planning department head, so in the matter of handling office employes, the selection, training and guiding is intrusted to the office planning department. Many concerns which never before thought of a planning department have already developed good systems for handling their employes. Generally these functions are connected with an employment bureau, where adequate records of present and prospective employes are kept, and all the office positions are listed and analyzed as to qualifications necessary for their incumbent. There are, however, many reasons why these functions should be consolidated with those of the planning department. They are all activities which affect the organization as a whole, and by bringing them within the compass of one department, the same advantages will result as in the case of the factory where the draftsmen are in close proximity to the store clerk in the planning department. They both have a common interest in the "bill-of-materials schedule." The development of efficiency records in the office goes hand in hand with salary standardization, while the grading of work is closely associated with promotion plans. If the keeping of records of service and other qualifications are to be functions of

the planning department, the question of superannuation, and pension and wage systems should likewise be in close association with those activities which must be factors of more or less importance in the determination of general welfare policies.

10. *Organization of the planning department.*—In large commercial organizations where the greater part of the work falls upon the office, the function of planning is gradually becoming specialized. But the small office organization must meet many of the same problems that the larger one does. If its resources will not allow of a special department, with its necessary complement of executives and clerks, the study of the methods used by a large planning department will prove of inestimable value in enabling the office manager to classify his office activities and in at least permitting him to schedule his own efforts with a clearer vision and with better results. Here he shall find that the main work of an office consists of the following elements: organization routine and equipment layout, work processes to be studied, standards created and checked by continual improvement, daily operations in dispatching orders thru the office, and the cultivation of cooperation and loyalty among the workers by carefully selecting and caring for them, and by planning for their scientific training and guidance.

In the case of larger offices, where there are one hundred or more employes, the planning department can be used to especially good advantage.

11. *Personnel of the planning department.*—The permanent membership of the planning department will correspond in a general way with that of the production department in the factory. No general rule as to members and the division of their work can be laid down, but we give below the judgment of Mr. H. A. Hopf, of the Phoenix Mutual Life Insurance Company of Hartford, Connecticut. His methods as applied to office organization have proved themselves very efficient.

The permanent staff of the planning department should consist of a manager and a male clerical employe. Stenographic and typewriting service should be supplied by the stenographic department, but it might be deemed advisable to assign a special stenographer to the planning department, by reason of the fact that much work of a confidential nature would have to be performed, and it might, therefore, be best to locate the stenographer in the planning department itself.

Upon the manager of the planning department a considerable share of the responsibility for the success of the work would naturally rest. It is a matter of course, therefore, that he should be carefully chosen with respect to his qualifications for the work. The clerical employe, apart from the usual qualifications, would make himself especially valuable if he possessed capabilities as a draftsman. Furthermore, he should have an analytical mind and be able to obtain information from various departments without creating friction.

To make the work of the planning department really effective, it should reach out into all the departments of the organization and endeavor to supplement its functions by special planning in the individual departments themselves. This could best be done by the temporary assignment to the planning department of well-qualified and ambitious employes of various departments, who would serve in the planning

department in rotation, usually for a period of thirty to sixty days. This arrangement, if carried out systematically, would enable specially qualified employes from all over the organization to gain the broad viewpoint so essential to proper development, and would put them in a position more effectively to study the special needs of their own departments.

In this manner, the better grade of clerks in the organization would be encouraged to develop reasoning and observation faculties, and would gradually form a special group from which undoubtedly many promotions to various lines of work in the office could be made as vacancies might occur. Employes would serve one at a time in the planning department, preferably during the slack periods in their own departments. This would enable the planning department to develop from six to twelve men per annum by means of special training, and the individuals so chosen could perform the regular functions of the planning department and act as scouts in securing information from all directions.

The period of service might be termed a course in planning, and it may be taken for granted that when the department representative returned to his own department he would not only have a much better grasp of the work thereof but also a far clearer conception of the needs and requirements of different departments all over the organization.

REVIEW

If you examine the history of the average office, what do you find to be the circumstances attending the growth and expansion of its system of organization?

Having planned the work, and having decided upon a system of routing the work thru the office, can the manager neglect to give it his constant thought and attention?

What is your estimate of a manager who listens to suggestions that have proved themselves valuable when used by other concerns, but answers all arguments by, "Yes, that may be all right—but my business is different"?

Is aggressiveness in a foreman or an office manager a sure

sign of strength? How can a planning department protect a business against weak aggressive men?

What activities do you see in a large office that are common enough to all office work to be standardized?

What three types of records would you be able to keep in any office?

What influences have been at work making standardization necessary in office administration?

What can be done in the way of planning the welfare work of a large office?

Compare the personnel of the planning department of an office with that of a factory?

CHAPTER XIV

STANDARDIZATION—MATERIALS AND EQUIPMENT

1. *Correct standards the basis of administrative judgment.*—A sound judgment is the prime mental attribute of a good manager. When a manager fails he is criticized for not using good judgment. But to accuse a manager of exercising poor judgment is only to say that he has used wrong standards in drawing his conclusions. Judgments are the results of comparisons. When comparisons are made we consciously or unconsciously use one thing as a standard by which the other things are measured. When the full moon rises from behind the hills we say it is as large as a wagon wheel. When it is overhead then we say it is as large as a plate. In these cases we have unconsciously compared the moon with certain objects and as the moon moves from one position to another our judgment varies.

2. *Management a series of measurements.*—A great economist once said that all economic activity in its last analysis resolves itself into the simple process of moving matter. It might with truth also be said that the problem of management resolves itself into a series of measurements. Every manager has some standard. The difference between a progres-

sive and a nonprogressive manager is largely determined by their attitudes toward the standards which they use. The one, having decided that a certain type of machine or a certain kind of man or method for performing an operation, is the correct one, rests contented with using these units as standards year after year; the other is continually on the lookout for improvements in his machines, men and methods, and frequently changes his standards in order that he may judge his efficiency under new conditions.

3. *New standards changed plane of competition.*—When the Carnegie Steel Company entered the competitive fight which finally resulted in the formation of the United States Steel Corporation, it was truly a "battle of the standards." Mr. Carnegie proved himself to be the most progressive manager of the day, in view of his attitude toward standardization. While other companies were judging their efficiency by the capacity of old equipment, Mr. Carnegie was equipping his plant with new and up-to-date machinery. His standards were of the twentieth century, his competitors' standards were of the nineteenth. Since Mr. Carnegie's success few men have questioned the necessity of continually watching their machine standards in determining the efficiency of their output. The general acceptance of this principle was a great step forward. Yet the problem connected with the determination of machine standards is a comparatively simple one when compared with the determination of those standards which are

connected with men, and which become the basis of judging labor efficiencies.

To establish rational work standards for men requires indeed motion-studies and time-studies of all operations, but it requires in addition all the skill of a planning manager, all the skill of the physician, of the humanitarian, of the psychologist, of the physiologist; it requires infinite knowledge, directed, guided and restrained by hope, faith, and compassion.¹

4. *Standards of labor efficiency.*—The difficulties of the problem, however, should not deter any manager from beginning to study the conditions surrounding his workingmen. The next great step forward in the organization of our industry will be along the lines of finding and adopting the true standard conditions under which men shall labor. Perhaps when the next great competitive battle is fought the manager who can measure his fighting strength in terms of labor efficiency will inscribe his name higher on the list than that of any of the great captains of industry of the past. Such a man will have standardized his conditions and will know that he will be wasting less time, squandering less effort and spending less money than any of his competitors.

As before noted, every manager has standards of some kind. Evidences of these standards are seen in written specifications, in the purchase of materials, goods, etc. But as we approach the operations which the men perform and the conditions under which they

¹ Harrington Emerson, in "Twelve Principles of Efficiency," page 275.

work, these records grow rarer and rarer. Seldom do we find written specifications covering what might be known in a given concern as standard practice. But when it is realized that standard operations and standard efficiency are as valuable to a firm as standard materials and standard machines, then will be seen the true functions of the planning department and its record of standard practice.

5. *Objections to standardization.*—Perhaps the commonest objection to adopting standards, aside from the difficulty of obtaining them and of keeping a permanent record, is that they will destroy the initiative and incentive of the workman. Those who raise this objection seem to reason that when a standard is once adopted it is to remain forever. But standards are ever changing, and that is the reason managers are needed. No sensible manager of today will ignore any suggestions from his men which may improve his standard practice. All that such managers require is that the men first show themselves capable of accomplishing work according to the standards that are set by normal conditions. Absolute standards can never be set in business; therefore, there will always be plenty of opportunities for the exercise of the workman's ingenuity.

6. *Cautions in adopting business standards.*—Perhaps some caution, however, might be suggested regarding the establishment of standards. In business, that particular standard is desired which will produce the largest output with the least effort or cost under

the existing conditions. One of the chief considerations is the human element. In a shop employing one hundred men, one man might be found who would be able to do a given piece of work three times as quickly as anyone else. If this man's accomplishment were taken as the standard and the other men were forced to meet it, the output in a very short time would fall appreciably. The men working beyond their strength would soon show the result in their lagging energy. The excellent man's accomplishment should not be the standard for the good man's effort, because it is the latter upon whom the management must depend in the long run for its steady output. Normal conditions, and not "spurt" conditions, should control. The schedule should be made so as to allow for the general run of men, but should permit a place for the unusual as well as the mediocre. As Mr. Emerson says, there are places where the poor men may fit, even as the tame goose plucked for his feathers and prepared for the feast shows one hundred per cent efficiency, whereas a thin wild goose is far below par; but the efficiency would be reversed, in the case of the goose, if flight instead of diet were being considered. The schedule must fit the man and the man must fit the schedule. There is no such thing as a universal schedule.

7. *Standard materials, first step.*—Among the first departments into which definite standards were introduced were the purchasing and contracting departments. These standards have proved their worth to

such an extent that every business is familiar with them. The extent to which specifications have been standardized is remarkable, and the results are significant of what might be done in other fields.

Too much emphasis cannot be placed upon the fact that standardizing is a continuous process. No specification is necessarily perfect, and modifications and remodifications, which only experience will develop, must be made to meet constantly changing trade conditions and to correct fundamental defects.

8. *Standard quantities, second step.*—The quantity of each kind of material to be kept on hand and the amount to be purchased are involved in the second step in standardizing materials. The object in view is to prevent the annoyance of running short (so common in all unorganized stock rooms), to purchase sufficient quantities, to secure good prices and still not to lock up an unnecessary amount of capital. This object is accomplished by establishing a minimum below which the stock must never be allowed to fall. The minimum depends upon how long it takes to get supplies delivered, how fast the material is generally used up and how rapidly it deteriorates. Sometimes a secondary or emergency minimum is added, if the new supplies have not come in before a dangerous point is reached, to call special attention to that fact. The amount to be purchased depends upon the saving to be gained thru quantity buying, the room and help available for handling, the capital tied up, the seasonal variation in prices and the amount that is used.

These figures are generally placed directly on the material-ledger accounts so that the stock clerk can see instantly when supplies are running low, and can replenish in time.

9. *Monetary savings due to standard materials.*—

One of the big advantages of standardizing materials is the direct monetary saving. An examination of the supplies used will generally show a surprising variety in the kinds and grades of the same article. The Commission on Standardization of the City of New York found that the city had twenty-five different standards for horses, and numerous standards for coal. They have been able to classify all the city requirements under seven grades for horses and one specification for coal. So far, the Commission's work has covered only one-fourth of the city purchases, but if the 5 per cent saving effected thus far can be applied to the whole \$22,000,000 which the city spends annually for supplies, the saving will be over a million dollars a year.

Since the introduction of standard materials is not hampered by existing conditions—new materials of one kind or another must be ordered from time to time—it provides the ideal way to begin standardizing.

10. *Standard office material.*—Office material is a particularly good field for standardizing, since differences in stationery rarely have any more logical basis than chance. For instance, many kinds of carbon paper, typewriter ribbons, pencils, pens and erasers

are found in every office, together with many different shapes and sizes of account books, forms, etc.

11. *Example of standard drawings.*—The multiple system of standard-sized drawings which is universal in large drafting offices can be used to advantage in general office work. In this system the fact is recognized that all drawings cannot be made on one size of paper even tho such a method is very desirable. A given large size is adopted as standard, which is divided into halves, quarters and eighths for smaller sizes. By this arrangement all drawings can be filed in cabinets of uniform size by dividing the drawers to correspond with the smaller drawings. As the standard-sized sheet is always selected, the paper can be cut to the best advantage and without waste. For instance, if the standard or A sheet is 23 x 36 inches, which is a stock size of paper, the four sizes allowed in the office would be:

Full sheet A—23 x 36.

Half-sheet B—23 x 18.

Quarter-sheet C— $11\frac{1}{2}$ x 18.

Eighth-sheet D— $11\frac{1}{2}$ x 9.

The multiple system has also been adapted to shipping, especially in seed houses, where the packages for different quantities are all multiples of each other. This permits all orders to be packed in boxes of the same size. Orders too large for one box can be packed in several separate boxes and the boxes can be nailed together with strips on the outside. This

saves storage space in the shipping room and greatly facilitates the routine.

12. *Standard equipment.*—It is better to have all the machines second class than many first with a few second and third class, because the operators on the first-class machines will regulate their speed to that of the workmen on the second and third-class machines. Thus the efficiency of the first-class machines is always lowered to that of the poorer ones.

All machinery, however carefully watched, wears out and breaks down. To avoid costly delays it is therefore necessary to carry repair parts in stock. If one type of machine is used, one set of parts will be sufficient for all breakages. The probabilities are against two machines breaking down in the same way at the same time. If two kinds of machines are used, two sets of parts become necessary, because the parts of one will not interchange with the parts of the other. If many makes are used, many sets of repair parts are necessary. Unproductive capital is locked up in these parts, increasing the indirect expense. Machinery manufacturers are waking up to the importance of this matter of repair parts, so that it is now possible to get a complete range of tools, the parts of which are interchangeable; fewer parts consequently need to be carried in stock. It is also good practice to select the entire equipment from one or two firms, provided the purchaser does not become too dependent upon one source. Any advantage of heavy machines of different makes is often more than offset by

a gain in uniformity. Where a firm manufactures much of its own machinery it is advisable to carry out the same idea.

13. *The principle as applied to delivery systems.*—That the tendency with large companies is toward a standardization of their delivery and office equipment no less than of their production machinery, is shown by the following advertisement:

Another big order for — trucks was placed yesterday — an order for ten from the Long Island Express Company. This concern already has ten — trucks, purchased on January 31, 1911. The reorder makes twenty of them, all told, \$72,000 in — trucks.

Rather significant is this order. When a big company invests as much money as this in one manufacture of truck, its own answer to the motor-truck question is clear.

But consider for a moment what other express companies have in the way of — trucks: American Express Company, 27; Westcott Express Company, 11; Adams Express Company, 4.

These three express companies have an investment in — trucks of \$161,000. Four companies, all told, total \$233,600 in — trucks, an investment that is greater than the capital of many motor-truck manufacturers.

14. *Interchangeable parts.*—More important than the number of designs is the matter of standard or interchangeable parts, both of the same machine and of the machines of an entire line. Mr. C. U. Carpenter, in his "Profit-Making Management," summarizes as follows:

The great advantage of standardized products is, of course, apparent. It means cheapening production thru

duplication of parts and ease of handling; increase of output per square foot of floor area thru quicker production, and the consequent reduction in indirect expense per piece; the possibility of building for stock in slack times and so keeping up the factory output; quicker deliveries and more orders, better satisfied customers, and a more rapid turning over of working capital.

The differences in legs, screws, pins and other unimportant parts of machines are largely the result of the individual designer's whim, and should be obviated. The Engineering Standards Committee of the Institution of Civil Engineers discovered in their investigations that a large part of the differences in British rolled sections had been deliberately introduced by the manufacturers, so that duplicates and repair parts would have to be ordered from the original maker; and that, instead of having the desired result, this action, because of the need of special tools and dies and the expense of changing rolls, had so increased production costs that the American and German plants were gaining the trade by underselling. Where small parts are standardized, the need of continually redesigning them is eliminated and consequently the designer can concentrate his skill on the essential elements of the problem.

15. *Importance emphasized by Whitmore, 1841.*—The importance of interchangeable parts was first emphasized by Joseph Whitmore in his paper, "A Uniform System of Screw Thread," read before the British Institution of Civil Engineers in 1841. Such a system was first generally adopted by American

watch manufacturers. During the middle of the last century some of these manufacturers made a lasting impression on foreign engineers by dismantling two watches, mixing the parts with similar unused stock parts and then reassembling the watches as the foreigners handed them the parts, selected at random. Similar astonishment has been occasioned in more recent times by certain of our automobile makers, who performed the same severe test; they dismantled a car after a long run, mixed the parts with similar stock parts and after reassembling them made another long run.

16. *Use of "limiting dimensions."*—To insure the fitting together without any filing of parts which have been made by different workmen, the system of "limiting dimensions" has been developed. This system provides that important dimensions shall be marked in an appropriate manner as to the maximum variation allowable if the part is to match with its neighbors. The workman thus knows where special accuracy is required, and is supplied with limiting gauges for testing his work.

REVIEW

Would you advise your company to develop certain standards and, after adoption, to hold to them without change?

In establishing a labor standard for a certain job, would it be good practice to choose the best workman in the shop, and set up his accomplishments for the day, or the job, as a standard for all the other men?

Why is the office a good place in which to begin the adoption of standards?

A manufacturer who had a mixed assortment of machines, some high grade and a few of the second and the third class, found that his output was far below the average. What effect would be produced upon the labor by the adoption of a standard second-class machine thruout?

What is meant by "limiting dimensions," in connection with the subject of standardization?

CHAPTER XV

STANDARDIZATION—SYMBOLS AND ROUTINE

1. *Use of symbols.*—Convenience is promoted by the use of symbols. A good symbol system must be: (1) unmistakable; (2) easy to remember; (3) brief.

The usual terminology of tools and parts is very loose. The meaning in which words are used differs widely among different firms, and the same word is often used for several ideas; it is consequently necessary to determine which one is intended. The first step in symbolizing, therefore, is to adopt definite names in accordance with both current commercial usage and dictionary definitions. As one of the chief purposes of a symbol is to correct the vagueness of common language, it is essential that each symbol be applicable to only one definite thing or idea.

2. *Constructing a system of symbols.*—A symbol involves two things, a sign and a position. The sign may be a letter, a figure, some borrowed character, such as a Greek letter, or something manufactured to serve the purpose. Where there are enough signs to indicate all the classes, position is unnecessary. This is the case with the chemical symbols. N stands for nitrogen, whether it is at the beginning, as in NH_4Cl (ammonium chloride); in the middle, as in NaNO_3 (sodium nitrate); or at the end.

Where, however, there are not enough signs to go around, position is added for significance. The digit 6 means sixty in the second place (60), and six hundred in the third (600). Where letter symbols are united to form groups, it is preferable to have combinations of capital and small letters, as in the chemical symbols, rather than to have all capitals, because by the former method spaces are more easily distinguished. Each succeeding capital represents a place. In using numbers, it must be remembered that the range of any one column is 0 to 9, not 1 to 10. Where letters and numerals are used together it is better to alternate them. It is also advisable to omit the letters I and O lest they be mistaken for one and zero.

3. *Symbols an arbitrary measure.*—Symbol systems are “standards of measure” and must not be continually changed. In order to avoid confusion they must be definitely, even if arbitrarily, established. In fact many of the speakers before the American Society of Civil Engineers have claimed that this is the great advantage of a number system, since such a system makes no attempt at being logical. When it is once established there is little temptation to alter it.

4. *Advantages of mnemonic system.*—Mnemonic means “aiding or designed to aid the memory.” The advantage of using mnemonic symbols is that less referring to charts is necessary and consequently there is less likelihood of mistake. As a general rule, letters, especially when related to the words they

stand for, are more easily remembered than numerals. The two-letter system is the one most generally used. Its 676 possible symbols are ample for most requirements. The letters should be either: first and last letters as Rm, for Ram; or first and second letters as Fr for Frame; or first letter and a letter indicating the sound as Dy for Die. Where none of these combinations is possible the same end can be attained by making the letter so extremely inappropriate as to be conspicuous. This is doubtless the idea back of the X for Inkstand in the Derby Desk system described below. The memorizing of symbol systems is not so formidable a task as it appears, because each man uses comparatively few of the total number and need remember only those he uses.

5. *A working system.*—As one example of a well-constructed system, among many that might be given, take that used by the Derby Desk Company. In this system the following capital letters, the mnemonic value of which should be noted, are used to indicate types of products:

H—High roll-top desk.

L—Low roll-top desk.

C—Special roll-top desk.

S—Flat-top desk.

D—Double flat-top desk.

K—School-teacher's flat-top desk.

F—Flat-top typewriter desk.

DF—Double desk with one side arranged for typewriter.

PF—Flat-top desk with typewriter instead of right-hand bank of drawers.

R—Roll-top typewriter desk.

B—Bookcase.

RB—Revolving bookcase.

P—Coat tree.

X—Inkstand, single.

DX—Inkstand, double.

M—Letter tray.

MC—Map and chart case.

T—Table.

U—Umbrella stand.

W—Wardrobe.

6. *Application of the system.*—As most of this company's desks are made both with sanitary legs and with drawers to the floor, sanitary designs are indicated by prefixing the letter O. Styles of desk or bookcase under each type are indicated by serial numbers. The length in inches follows the style number. Then comes the type symbol, and finally the number of the catalog (serially numbered) in which the desk is described.

Take, for instance, the symbol O3360DF8. To one who is familiar with this system it is at once apparent that this refers to a sanitary desk, style 33, sixty inches long, a double desk with one side arranged for a typewriter, described in catalog numbered 8.

This is not at all a complex system. It takes only a short time to become thoroly familiar with it. It

tells all that is necessary in order to identify any product, and thus prevents indefiniteness and saves a great deal of time.

7. *Use of numbers in symbols.*—Size is best expressed and most easily remembered as a numeral. A series of arbitrary numbers is suggestive of the relative size, not the actual. It is better, if possible, to use some characteristic dimension. This is more descriptive and allows the adding of new sizes in their logical order without disturbing the existing symbols. Where arbitrary numbers are assigned, a sufficient number of blanks should be left to cover all future additions.

In addition to preventing misunderstandings, symbol systems save a great amount of writing on drawings, requisitions, stock records and time-cards; many managers consider this saving in clerical labor the greatest advantage of a symbol system.

8. *Symbols for manufacturing.*—Symbol systems may be roughly divided into four classes covering:

1. Finished product.
2. Parts.
3. Operations.
4. Tools and machines.

The usual method of symbolizing the finished product is to divide it into classes; to designate each of these classes, if there are less than twenty-seven, by a single suggestive letter; and to represent the different members of the class by consecutive numbers. Thus a certain line of presses may be grouped as follows:



Class B—Bench Presses of all kinds.

Class C—Cutting, Horning and Wing Presses.
Power, Single or Double action.

Class D—Drawing and Deepening Presses.
Power, Single or Double action.

Class E—Embossing and Coining Presses.
Power, Toggle or other.

Class F—Foot and Hand Presses—Lever Pendulum Screw, etc., Single or Double action.

Class G—Gravity Presses, Drops, with Hand Foot Crank Belt over Roller Lifter.

Class P—Punching and Shearing Presses. Power, Throated.

Class S—Stamping and Bending Presses. Power, Double-crank, Composite frame. Throated or straight, upright or inclined rectangular or round beds.

The individual presses are C1, C2, C3, E1, E2, W3, etc.

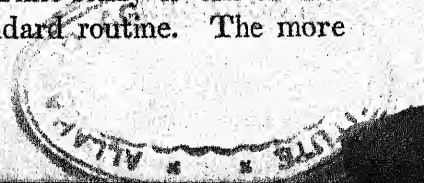
9. *Improving this method.*—A better method, however, wherever possible, is to make the symbol descriptive, as are the chemical symbols, by combining a number of their elements. Thus there will be fewer symbols to remember and anyone can pick out the meaning of the combined symbol, even if he has not seen it before. The Derby Desk Company's system is of the descriptive kind.

There are two systems of designating parts. The older one numbers the parts of the finished model consecutively. If P1 is the model symbol, the part

symbols would be P1-1, P1-2, P1-3. The great disadvantage of this system is that with an increase of interchangeable parts the same part used in two or more machines will have two or more symbols. This makes stockkeeping difficult and perpetuates one of the very faults the system was designed to eliminate, the confusion of common terminology. Its advantage is that the trade, in ordering repair parts, will not confuse parts of different models.

10. *Aims of newer methods.*—The newer method aiming at fewer drawings, alternation of existing patterns whenever possible, and the development of interchangeable parts, takes the part as the basis and builds up the final model. This second system is, in its nature, the direct opposite of the first. The parts are grouped according to their similarity, not their use. All bolts, for instance, would be classed together as bolts, and then would come such particulars as material and size. This greatly facilitates stockkeeping, and throws on the designer, where it belongs, the responsibility of making up a correct bill of material for each manufactured article. In order to prevent confusion, the drawing and the pattern should be designated by the same symbol as the part, and this number should be stamped on the part in some way, so as to facilitate work in the factory and make it possible for customers to order duplicate parts without consulting a catalog.

11. *Standard routine.*—Time-study is one means by which to develop a standard routine. The more



common method in practice today is to establish standards on the basis of experience. This method approaches the problem not from the standpoint of the work to be done but from that of the best previous performance, and is more or less unconsciously followed in all businesses. One man in a shop will turn out more work than his neighbor. His method is studied and made the standard for the shop. By and by, someone else, perhaps a foreman, will discover a short-cut and so, little by little, the efficiency increases. A thoughtful clerk works out a new way of handling credits, which the office adopts. The sales manager seeks suggestions from his older salesmen, which he tries out and finally crystallizes into a manual, the codified best-way-of-selling. The difference between the standardized and the common practice is that each advance is at once officially recorded where conditions are standardized, whereas, in everyday life, advances are recorded by tradition alone and so are likely to get lost.

Harrington Emerson has graphically compared standardized practice to a ratchet which holds everything gained so far, without in any way retarding further progress. The business executive can stop a moment to rest and reflect without letting the business deteriorate. One man starts where his predecessor left off, instead of spending his time on a problem which has already been solved. It is the ratchet system.

12. *Steps in developing standard routine.*—The

first step in establishing a standard routine is to find out exactly what the present procedure is. One way to determine this is to have each employe write out exactly what he does, together with any suggestions that he may wish to make concerning the improvement of any phase of the work. The next step is to work the best of these suggestions up into a manual to serve as a standard until something better is evolved. This is only preliminary, but it must be done whether standards are to be developed by time-study or by evolution, the better method usually being to employ both methods. The introduction of a standard routine is often delayed unduly while the standard is being perfected on paper, and thus much of the advantage of the standard is lost and its ultimate perfection delayed. The quickest way to get a standard adopted is to place it in concrete form before the office, shop or sales force. The worker must then agree or disagree; his test will prove the standard right or wrong. In either case, his ideas are focused for the use of the office.

13. *Profiting by the experience of others.*—It is also advisable to profit by the experience of others. Mr. Gilbreth gave the following testimony before the Interstate Commerce Commission:

We furnish our men with eighteen bricks in what we called a pocket for the want of a better name. That pocket consists of a tray with four slats, two this way and two that way for handles. I got the idea for that from Mr. Taylor and Mr. Gantt in the matter of handling pig iron at the Bethle-

hem Steel Company. They found after long experiment that 92 pounds was the best unit for handling pig iron. If that is true of pig iron, and the laborer makes no use of the material he carries, it must be true also of brick. So we arranged to have the pocket that would best handle 92 pounds of brick.¹

Care must be exercised, in adopting other standards, to make sure that conditions are the same or to make due allowance for local conditions. Differences in machinery, hardness of metal, and such factors, apparently only details, will entirely change the amount of work which can reasonably be expected.

14. *Function of technical societies.*—The development of standards both of measure and of routine is one of the principal duties of the technical societies. For example, the American Street and Interurban Railway Association in 1906 adopted, and recommended for use by its members, a standard code of rules for the government of conductors and motor-men. The American Railway Master Mechanics' Association recommended a standard apprenticeship in 1898, which they have amended from time to time. The American Institute of Architects in conjunction with the Master Builders' Association have adopted a uniform building contract. There is also a society specially organized to promote uniformity in methods of testing cement.

15. *Value of printed records.*—Routine, however developed, should at once be put on paper. The rapid progress of civilization since the introduction of

¹ Brandeis, "Scientific Management," p. 27.

printing, as compared with that of the centuries before, shows the efficacy of the printed record. The record of business routine operations is known as a manual, and it is surprising to see how universally applicable its regulations are. In the office, the correspondence manual contains a series of carefully worked out paragraphs covering routine questions, by the use of which the correspondent can greatly reduce the time necessary to handle his mail. The manual of the Long Island Railroad contains 773 rules covering the duties of different employes, how to make up trains, the rights of trains, how to signal, etc. Similar codes are in force on all the other railroad systems. Most department stores have their "Book of Rules." The "Standard Book" of the Westinghouse drafting room contains twenty-four drafting dictionaries which specify: lines to be used; letters and figures; methods of sectioning; mechanical features, such as size of sheet, position of title; element charts; illustrations of the elements of their various machines; illustrated index of terms used; digest of the 400 pages of circular instructions issued from time to time; and sample drawings and abbreviations.

16. *Advantages of loose-leaf manual.*—While the material in the manual, and not its form, is the important thing, nevertheless it is convenient, where the firm is large, to publish the manual as a loose-leaf book, small enough to slip into the pocket. Changes can be made from time to time without republishing the whole book; and because of its convenient form

it can be carried around and can be readily referred to. It should be fully indexed to facilitate its use. In small companies it is convenient to type, mimeograph or blue-print the manual. An even simpler form is a scrapbook in which are pasted copies of each specification for material and of each letter of instruction which the office issues. This kind of manual is not so convenient as the others, because the material is not properly classified, and duplicates cannot be issued without considerable trouble.

REVIEW

Why do business men adopt abbreviations for certain words, etc., as soon as their business becomes large and complex? Describe a natural system of symbols?

What principle underlies the practice of symbolizing the finished product after dividing it into classes, by designating each class, if there are less than twenty-seven, by a single suggestive letter, and by representing the different members of the class by consecutive numbers?

Show how time-study may be related to the development of a standard routine.

The manager of a certain office, upon hiring a new man, always spent considerable time in explaining the office routine to him. Afterward he noticed that each employe in any one department had a different conception of his duties and that frequent talks were necessary to keep the men doing the work in the way he had described to them. How could this defect be remedied?

CHAPTER XVI

STANDARDIZATION AND LABOR

1. *Goal of every producer.*—One of the chief differences between machine-made and hand-made goods is that the latter possess greater individuality. The recent revival of the handicraft trade shows what a strong hold this quality in a ware has upon the consumer. Nevertheless, when the producer of a hand-made article finds that competition is threatening his market he begins the standardization of his product. He may first adopt a definite brand for his article, by which method he hopes to impress a community with the fact that his goods possess a standard of purity or some other excellence which is highly desired in the market. Failing to monopolize the trade by this method, he may attempt to hold his market by a reduction in the cost of making his goods. If his goods are made altogether by hand, the costs will be lessened by turning out a larger product than before in a given period of time. This he can do with the best results if he makes a standard type and confines himself to manufacturing it over and over again.

2. *Production limited by hand labor.*—This is standardization, but its effects cannot be carried very far under a system of handicraft labor, for the working power of a man is limited. However, with the

addition of steam power and machinery to the workman's shop, the problem of fatigue is largely solved; the question of being tired does not apply to either the engine or the tools. The more work the machines can be made to do, the higher will be the productive capacity of the shop. Thus, even in a primitive factory where tools and machines are simple, and the motive power chiefly that of the operator, attempts will be made to use the equipment as much as possible according to some sort of standardization. But before the producer can determine the highest efficiency of a shop, he not only must know his own endurance and skill, but must determine what the possibilities of his machines are under the best conditions.

Here then we have the whole problem of standardization, which has become more and more difficult to solve. All machine work may be divided into two parts: (1) the work of the machine and (2) the work of the man who runs it. But as the years have rolled by, new inventions and new conditions have added many variables to an already complex problem.

3. Three factors conditioning output.—The three principal factors conditioning the output of both man and machine are speed, the character of the material and the tools. It is therefore necessary to determine what particular speed, what particular grade of material, what particular quality, what particular kind of tools can all be united in producing the greatest amount of goods of a given quality during any production period. When these have been determined

for each of the factors, we have what is known as standard speed, standard materials and standard tools. But while this problem is simple to state, the actual work involved in determining any one of these standards is enormous. It took Mr. Taylor, with a body of experts, a whole year to standardize the shovels in the Bethlehem coal yards. If the problem of standardization is so difficult of solution with so simple a thing as a shovel, what about the complex machine which has at least a dozen variables such as the angle of the cutting part, the angle of its edge, the depth of the cut, the speed of the cut, and so on? The combinations which are possible with even nine variables, amount to 416,880.

Thus a machine is actually capable of being set many thousand ways. It will be recalled that Mr. Taylor made over 50,000 recorded experiments in the determination of standard feed and speed for cutting metals.

4. *New standards must be developed continually.*—As the size of the industry increases and the number of men and machines grows, it becomes necessary to apply the principle of standardization¹ to new processes, equipments and appliances. Thus we find standard times for handling the work, standard times for assembling, standard office forms, and finally a standard wage, which rests upon a consideration of

¹ In the Santa Fé system of transportation, referring only to the various shops, roundhouses, etc., there are 23,000 operations recognized as standard, with additions being made every year.

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the relations of all those processes which have been standardized, to the labor which is necessary to direct them.

The standardizing of a product, a tool, a process or a relation, depends upon the removal of as many as possible of the variable or uncertain factors. What may be a standard under one set of productive conditions may be entirely set aside under another, because some uncertainty connected with the old standard has been removed. The measure, therefore, that is used in a factory in determining its productive efficiency, or the efficiency of any part of the productive process, is the lowest possible time in which each piece of work can be completed. This is known as the standard time. A standard time, however, is simply the reduction of a product to its lowest terms, the product being made up of a number of other predetermined standards.

5. *Standard time as determined by experience.*—When a foreman turns over a job to a workman and says, "John, this ought to take you one hour," it is very doubtful, in the majority of cases, that either of them has the slightest idea of the immense amount of study and work which lies back of this simple statement. The standard time for this job in the mind of the foreman is one hour. But why it should be one hour rather than some other time he could tell only by saying that he had found this to be about right after years of experience; and he might even add that this was the standard time in all the shops that he

knew, and that the foreman before him had worked under the same conditions. This is the method by which standard times in both the shop and the office have been established, and it represents the way in which rule-of-thumb standards have developed. Probably years of time, thousands of men, and hundreds of thousands of jobs have contributed to the experiment of which the total outcome was summed up in the foreman's direction: "John, this ought to take you one hour."

6. *New conditions make time-standard hard to obtain.*—Modern investigations show that standard times which have been determined by the experience of the past are not always safe guides. The man who can do the work does not necessarily know the best way to do it. Mr. Gantt gives a record of a plant where the standard times in the running of a loom were based upon usual practice. The manager, however, after a short investigation considered the plant ready to adopt scientific management; accordingly he adopted an arbitrary new standard time. He put a weaver at work upon a loom, but on the very first day the schedule broke down. The next two weeks were spent by the management in studying the adjusting of the parts, and in getting the bobbins filled properly so that the loom would be uniform and standardized. Not until all this had been done could the management in fairness ask the worker to do the job in the new standard time. Then he did it, and the weaving was gradually accomplished on the new basis.

7. *Some general considerations in standard times.*—The determination of the time-standard is one of the biggest problems before every factory and office of to-day. It involves the whole question of time- and motion-studies besides many problems of human fatigue, and the like. Therefore, there will be no attempt here to do more than point out some general considerations which should be observed in arriving at standard times. A study of them may serve as a caution to those managers who lose sight of the very important element of time when planning a reorganization of their factory or office, and who expect to get results within a few months or a year. The necessity for time-standards will be evident when the following conditions with all their variable factors are considered.

8. *To attain standard times in a shop.*—Modern conditions in the shop so different from the state of affairs of only fifteen years ago, have in general been brought about by (1) the introduction of high-speed steel for cutting tools; (2) the use of devices for handling modern material; (3) the provision of better working conditions. The first of these factors has affected the rate of production dependent on the machine; the second has established quick relations between men and machines; while the third has increased the rate of production on the part of the men. It will be necessary here to speak of the effect of the first two factors only.

9. *Standardize machines before getting standard time.*—In regard to the revolutionary effect upon fac-

tory work, the introduction of high-speed cutting tools stands next to the invention of the steam engine itself. Hence, before standard times can be established, the investigator must consider (1) the character and limitations of the existing machine tools; (2) the correct shapes for the cutting tools; (3) the proper temper of the steel tools; (4) the best running conditions as provided by various cooling agents, etc., and (5) the maximum speeds. All these factors having been standardized, the time that machine work should take may be easily calculated by reference to slide rules prepared for these data. But the work done by the workmen is a more difficult matter to determine notwithstanding the magnitude of the task which has just been mentioned.

10. *Records must be provided.*—When the standards suggested by the above factors have been developed, it is further necessary to establish an adequate system whereby all the data pertaining to production may be collected and so arranged that the management can feel assured that the plant is operating daily at the new standard of efficiency. Any facts bearing upon standardization may be used as the basis of other experiments. Of course, due consideration should always be given to the conditions existing at the time of the tests.

11. *Foremen and laborers must be taught.*—It is just as well to suggest that such work belongs to the expert alone; for it is sometimes forgotten that standardized physical conditions make up only part

of the requirements to be met before the standard time can be established. Intelligence in dealing with the new conditions is necessary. Foremen and workingmen must be taught to appreciate the changes and how to secure the results expected; and the gaining of this standard of intelligence is a prerequisite also to the introduction of standard times.

12. *Standard times in handling and assembling.*—The determination of many of the standards pertaining to materials, machines, speeds and the like, belongs to the province of the engineer. Many progressive managers are now extending the principle of standardization to other features connected with the making of goods. The handling of materials before and after they reach the machine, and the assembling of the parts into a completed whole are now receiving the same close attention that has been bestowed on the machinery processes.

13. *Elements in handling time.*—The time required to handle the tools, machines and materials in any large factory, is an important consideration. In the Watertown arsenal it took a workman 329 minutes to cut a gear. When the job was analyzed it was found that 152 minutes was the running time of the machine, and 177 minutes was the handling time taken by the man in assembling finished gears, putting in new blanks to be cut, adjusting cutters and lifting pieces to and from the machine. In making a study of this case for the purpose of getting at a standard time, it was found that the job could be done

in 220 minutes—109 minutes less than the actual time taken. The machine's running time was fixed; this saving all came out of the 177 minutes of handling time.

Handling time, as a whole, is divided into three parts: that devoted to (1) handling tools; (2) handling the machine; and (3) handling the materials. The handling of the tools takes the most time; it is estimated that in many cases this consumes 75 per cent of all the handling time. The handling of the machine takes 15 per cent of the time. The handling of materials takes 10 per cent.

14. *Sample of standard time in handling.*—"It is no uncommon thing," says Mr. H. K. Hathaway, "to see men spend fifteen minutes in trying to screw a nut onto a clamping bolt when 0.71 minute would have sufficed to perform the whole operation of lifting, adjusting and tightening the clamp to a machine." In arriving at a standard time for this operation he obtained the following data:

	Min.
To lift the bolt, block and clamp to table of machine.....	0.17
To put the bolt in slot of table	0.04
To remove nut from bolt by unscrewing with fingers	0.13
To clamp over bolt and on work	0.05
To put block under clamp	0.05
To put washer on bolt	0.07
To screw nut on bolt with fingers	0.13
To tighten nut lightly with wrench	0.07
To draw nut down tight with wrench	0.10
Total	0.71

If this simple operation is analyzed, it will be seen that only one of the elements of handling has been

considered, i. e., the handling of the tools. If we should desire to standardize the handling of the operations which accompany those of the drilling machine to which this clamp was attached, we would then have a standard time for that operation of the machine. Further, if it is desired to study the handling connected with the bar of iron which was held on by the clamp and drilled by the machine, another set of time-studies would give the standard time for that operation. Thus the standard handling time would be divided into four parts, each of which would be standardized. These parts are the time for (1) handling the material on its way to the machine, (2) setting up the job, (3) machining the work and (4) removing the work.

15. *Material-handling time.*—The method of handling material has been standardized by having certain operations, such as the piling or placing of parts, always done in the same manner, and by having the parts put in the same places each time the operation is performed. For example, in the handling of light pieces, where various operations require close attention, the stock may be carried in boxes of the standard size. This reduces to the minimum the number of sizes needed and effects a sort of standardization.

A second standard may be obtained by carefully selecting the place where the box is to stand. A low, strong table can be used. This table at once standardizes the spot where the stock shall be placed; and the fact that the workman becomes accustomed to

reach for his stock always in the same spot aids appreciably by inducing in him a set of standard actions. The conditions are now ready for a test for the purpose of determining the least time necessary to do the work. A series of stop-watch tests upon an active workman will serve as a basis for a standard time for handling this part of the work. It is well, however, to check this test by other trials performed by an expert "tester." The latter is really a standardized laborer.

16. *Standard assembling time.*—The establishment of a standard time for assembling work presents practical difficulties which are far more serious than those connected with machine standards. The variations in human judgment and skill are more difficult to determine than the peculiarities of a machine. In most factories the workmen dislike to have their best speed known to the management, for then if they do not attain it, a relative decrease of pay often results. The only general rule that can be applied in the determination of the standard times in this work, is to separate the assembling operations for any particular job into as small a number as possible. If a workman can be confined to three operations, or fewer, the problem is much simplified. But where the assembler has as many as ten different operations on a particular part, the solution becomes highly involved. The character of the difficulties in the way of the determination of this standard time indicates that the manager should help solve the problem. "The waste of time," says Mr. C. U. Carpenter, in his excellent book, "Profit

Making in Shop and Factory Management," "in the ordinary assembling department of the average manufacturing concern is almost beyond belief."

17. *Economy gained by a standard time.*—A test made by Mr. Carpenter on assembling work shows what can be done in effecting economy in this direction. Taking advantage of a strike in the polishing department, the manager adopted a system of determining the new men's standard times of assembling. Twelve expert polishers were assigned to instruct sixty-two green hands. A partial analysis of the work after a few weeks showed that a reduction of 40 per cent could easily be made in the rate paid, and still the men could be provided with a good wage. In three weeks it was found possible to put the entire force upon piecework at the reduced rate. The men were assured that no further reduction would take place and were urged to do their best. The records showed that at the end of a period of ten weeks, the average earnings exceeded \$5.50 per day, whereas under the old system they were only \$3.00 per day. And at the same time, the work itself increased so materially that at the end of six months the actual records showed savings in the payroll in this department amounting to over \$55,000 per year.

The relation of standard times to other features of organization is very close and vital. The determination of the "shortest time" in which a job can be done is the first problem to be solved in establishing a wage

system; and what standard times mean to the cost system has only to be mentioned to be realized.

REVIEW

Before adopting a standard output for a machine, why is it necessary to determine what particular speed, grade of material, and quality and kind of tools will best combine to produce the desired result?

What is the difference between hard-and-fast standards and standards set by scientific methods?

What is the difference between time-studies and motion-studies?

What conditions in a modern shop or office make the subject of standard times of great importance to the manager?

How would you proceed to establish the standard times connected with the assembling of a simple product like a chair?

CHAPTER XVII

STANDARDIZATION AND RATE-FIXING

1. *Chief elements in efficiency.*—The principal matters in connection with efficiency that have been treated so far are: (1) the centralization of manufacture at shops best fitted by reason of location or otherwise for doing the work; (2) standardization of parts, tools and operations; (3) supervision of materials, tools and methods, and the planning and designing of devices and tools to help labor and machines in reducing delays. There still remains a fourth topic for consideration—that which relates to the reduction of labor cost by the application of a system of wage payments and a system of adequate instruction.

2. *Standard time not always shortest time.*—In determining the standard time of any process involving the combined work of machines and men, the many difficulties that arise are largely due to the "human element." Some of these difficulties have been mentioned; among them is the difference in men's capacity to work. Therefore, before a standard time can be adopted for a particular operation, it must first be determined what the capacity of the average man is. If the standard time is based upon what the best man can do, and the average laborer is expected to reach

that standard, the failure of any wage system based upon it is practically certain.

3. *Standards for wage systems.*—Standards are of little value unless they can be used as measures in comparisons. A standard in a system of wages must be used in effecting two comparisons; first, the working efficiency of each laborer at different times; second, the working power of different laborers. By a consideration of these two comparisons, the manager is enabled to determine what the individual laborer is capable of doing from day to day, and what he ought to do as compared with the other laborers who do the same grade of work. This is a long and difficult task, but once working standards have been determined for a man, it then follows that the management must provide records by which costs and profits can be checked, and a proper incentive can be furnished which shall serve to keep the laborer diligently at work. How then may laborers be held to standard performances?

The machine requires as its return only the repairs and renewals necessary to keep it going. The laborer, on the other hand, asks as his return all that he produces. The nearer he thinks he is approaching this reward, the greater is the incentive to work. It is, therefore, not always a high wage that determines the labor efficiency of a factory but the system by which the wage is determined and paid.

4. *The moral responsibility in rate-fixing.*—In every mechanism, in every system, in every relationship between two persons, or between social and eco-

conomic groups, there is a point upon which the different forces or interests converge with a maximum effect. The entire operating success of the machine, business, industrial organization or social group, depends upon the man or institution that stands at the focal point, so balancing the forces and interests that a perfect equilibrium is obtained and the structure at this point is kept from yielding to the special strain. Such men, in the work of distribution, are the grain and cotton graders and other inspectors of staple products. Upon the judgment of these men depends the determination of the class or grade in which the necessities of life are placed, and in so far as they determine this they fix the price which the producer will get, and which the consumer will pay for these products. In factory and in office the rate-fixer holds a position similar to that of the grain inspector and grader. Grading and rate-fixing depend upon the same fundamental principles. One deals with commodities, the other with men, but both must discover the dominant characteristics that give commodities or men varying commercial values. One value pertains to the market, the other to the employer. And each, in its way, is of equal importance to the laborer. As a consumer, the wage-earner is interested in the price that he pays for his food and clothing—poor grading may cause the laborer-purchaser a loss, because he may pay for a quality which is lacking. As a producer, the wage-earner is anxious about the price he gets for his labor. Bad or slovenly rate-fixing may compel

him to take less for his work than he should get, because his job has been graded below the class to which it belongs. There is no other position in the business world where the moral responsibilities are greater than those of an inspector whose judgment determines the grade of commodity, goods and labor for any social group. Such men are standard-makers, and upon their standards much of the happiness of mankind depends.

5. *Trade-union opposition to rate-fixing.*—Said the old-time doctor who sold his own drugs, "It is silly, perfectly useless, to depend upon apothecary's weights for drugs, because it takes fifty times as much chloroform as it does cyanide of potassium to kill a goat." Analyzed, this statement simply means that a druggist's scales need to be used even by a man who knows the difference between chloroform and cyanide of potassium. Labor-union leaders often condemn premium systems by similar reasoning. "It is harmful, absolutely iniquitous to depend upon the Taylor system of wage payment for a square deal, because it takes fifty times as much 'minimum wage' as it does 'straight piecework' to kill a workman."

The point of view represented by such a statement is held by two distinct classes: (1) those who do not understand the principles of time- and motion-studies which underlie all scientific wage systems, but who are honestly endeavoring to get the most out of a very complex relationship between employer and employe, and (2) those who do not understand these principles

and who, because they do not understand them, fear that the principles will interfere with certain selfish interests. These men prefer to befog the issue rather than analyze the problem and establish the true relationship.

6. *The employe as rate-fixer.*—The premium or bonus idea in industry is not new. The difference between the old and the new application of the idea has to do, first, with the method of determining the bonus, and secondly, with the person relied upon to establish the bonus standard. The germ of the bonus system lies in the mind of every shop and office employe who believes that he should be paid a daily wage just for being "on the job," and that if the employer wants extra "results" he must give an extra inducement. The reply of the Liverpool Harbour Board's carpenter who applied for a job at the Mersey Dock office, shows how and by whom the bonus standards were established under the traditional systems of management. When asked what wages he expected, he replied, "Three shillings if I take the hammer here" (up near the head); "four shillings if I take it here" (half way down the handle); "five shillings if I take it here" (at the point where he could work most efficiently with it).

7. *The employer as rate-fixer.*—The labor problem is sometimes given a narrow interpretation from the administrator's point of view, as follows: "How can I, as manager, occupy all the time of my employes productively, continuously and profitably?" Driving,

false allurements and cut-piece rates have all served their day and, like all false methods, their after and indirect effects are worse than the immediate results. The distrust which laborers now have of every method proposed by the management is one of these indirect effects; and now that organized labor has forced employers to resort to some method other than that based on fear and guesswork, the good methods backed up by the high-principled motives which are now prevalent, must suffer thru the opposition of the unions, because of bad predecessors. The wage difficulties which now beset the administrators are a natural outgrowth of the old system of management, which put nearly all the productive responsibility upon the laborer. The laborer, not being able to pass the work farther down the line to someone below him, took advantage of his position to "scamp" and "soldier." The management then began to devise means of forcing a higher labor efficiency and, as a result, a number of wage systems appeared. The first of these was the straight piece-rate system. By its means, the manager sought to stop "soldiering" by paying only for what each man produced. This had its desired effect. It brought about overproduction from the management's point of view, and overwork from the standpoint of the men. To correct these evils, the employer at first cut the piece-rates, and the employe thru his union set a minimum wage. In this contest the unions won, but rather thru force than thru the championship of a correct principle of wage de-

termination. Next, the employer tried to overcome the trade-union prestige by accepting the prevailing daily wage of the locality, and adding to it a bonus or premium, provided a certain standard task was performed. This brings us to the first formal plan, now known as the Halsey-Towne premium system. Altho this left the situation very little better than before, yet it did show the weakness of any system which did not try to determine the nature of each task from direct observation before a rate of payment was attached to it. The fundamental weakness of this system was its reliance upon the past records of performance, and upon the workingmen's own estimate of what should constitute a reasonable time of performance.

To remedy this fault, the third step in the development of wage systems was introduced. Mr. Taylor, in his differential piece-rate system, placed the emphasis upon the importance of making a close analysis of each job before a standard of performance should be published. This study being made by the management and under the direction of experts, little importance was attributed to the old records of the employee or to the employee's estimate of his own worth.

In this, as in all scientific methods, lasting results and permanent progress could be obtained only by getting accurate measurements. The early investigators relied upon miscellaneous records and imperfect judgment; the later students of the question insist upon first, an isolation of the unit to be measured; second, standardized conditions in the method of meas-

urement; and third, devices for taking measurements which shall be free from the personal equation. These tests, having been applied to an office or factory job, resulted in the establishment of two important methods of scientific investigation before a wage rate can be fixed, or a wage system established. These methods are known as motion-study and time-study; in the development of each, two names stand out prominently. Mr. Frank B. Gilbreth, by applying the use of the motion-picture camera, the speed-clock and the cyclegraph to motion-study, and Mr. S. E. Thompson, thru his stop-watch tests and scientific time-studies, have made motion-study and time-study, as administrative aids, almost separate professions in themselves. Altho these studies are the basis of any scientific system of fixing the rate of pay, it is not possible here to go into-detailed description of them further than to remark that the fundamental distinction between the two is this: Motion-study is applied to the analysis of each operation, with the object of separating it into the most elementary motion units possible. Here time-study comes in and measures these units. Time-study, then, has to do, fundamentally, with the measurement of units. At this point, the motion-study element comes in again, since in establishing a new method of performing the work only the *efficient units* are combined. Then the operation may be spoken of as being standardized.

8. *Rate-fixing as a science.*—By comparing England and the United States, the progress of manage-

ment can be measured in terms of the position which is given to rate-fixing. In England, the rate-fixer's function may be summed up in the remark made by a prominent works manager: "A rate-fixer should be able to detect at a glance if the proper speeds and feeds are in use on machines he is constantly dealing with." And so far as the office is concerned, the great majority of concerns have given very little attention to either speed or feeds.

In America, the art has moved from a position where it depended upon the eye and experience of a trained observer, to the point where accurate measuring instruments, close analysis of motions and the selection of the most efficient are in use. With England, the United States recognizes the importance of the skill and experience of the foreman in following motions with his eye, and in judging the amount of time that they consume. Sight, hearing and touch must all be keenly developed, but this training fits an expert only in getting preliminary results, which can be obtained without the use of devices.

In American practice it is after this preliminary study has been made that the emphasis is placed. In making more intensive studies of certain trades, such as shoveling, concrete work, brick-laying and the like, it was found advantageous to photograph the various positions of the hands, arms and feet during the operation, as well as to record the time that the operator took to move from one position to another. And when all this was done for one method, the results

were compared with those of other methods. Mr. Gilbreth who, in collaboration with Mrs. Gilbreth, has done much in the cause of rate-fixing, in developing devices for accurately recording motion and time measurements, has been able to use the modern picture-camera in combination with a speed-clock so that movements in surgical operations have been recorded and timed to the millionth part of an hour. This fact is mentioned to show the direction which the science has taken, and the results which can be obtained in the study of motions. Such close measurements would seldom be necessary, however, in the study of motions pertaining to industrial and office operations.

9. *Rate-fixing as an art.*—The recognition of rate-fixing as an art distinct from foremanship, dates practically from the use of high-speed steel and the accompanying development of the premium system of wage payment. Mr. Taylor emphasized, as early as 1885, the necessity of segregating this function of rate-fixing, and the subject received similar attention at about this time on the river Tyne. It was not until 1900, however, that rate-fixing became, in both England and America, an important object of administrative attention.

In the case of machine shops—and the same principles would hold in other shops and in the office—Mr. Taylor divided the function of time-study so that it would apply to (1) preparation allowance and (2) operating time. In the following table, which has been adapted to English as well as American condi-

tions, we find the details for an elementary time-study:

A. Preparation allowance:

(1) Taking instructions from job boss (charge handwork, material, drawings, etc., at machine in advance).

(2) Obtaining tools (fixing, cutting and gauging).

(3) Preparing machine and setting up tools.

(4) Restoring machine to normal conditions, returning drawings, tools, etc., at end of job.

B. Operating time per piece:

(1) Cutting time.

(2) Securing and setting work in machine (crane service where needed).

(3) Changing tools (allow for grinding if not provided for by tool room).

(4) Starting out and sizing; also allow for returning the tool to starting point or any other place required (sometimes averaged as 25 per cent of cutting time).

(5) Gauging.

(6) Minimum rest period (sometimes taken at 5 to 12 per cent of net working time, items 1, 2, 3, 4 and 5).

Under a system of scientific management the above factors would be carefully planned and timed. In ordinary practice, however, the rate-fixer would look thru his records of the work done by the machine until he found a piece of work as nearly as possible similar to the proposed job; he would then guess at the time required to do the new piece of work. In determin-

ing the times in cases where close time measurements have not been taken, English and American practice would not vary much. Thus in the above, a close estimate of the possible operating time having been made, a margin of 50 per cent is added to establish an operating time limit. A similar method is allowed in the case of the preparation allowance. This 50 per cent is estimated by assuming that if the man does the job within standard time he will be paid at a rate based on one-half the time saved. He will thus automatically earn a bonus, or premium, of 25 per cent on his time wages, provided, as is often the case in England, the Halsey-Weir or the Rowan wage system is in operation. If straight piecework prices are paid, then a margin of only 25 per cent would be allowed upon the estimated (standard) time. Of course, if other rates of premium or bonus should be desired, then a corresponding adjustment would be made in the percentage allowance on standard times.

The safeguards against ill-judged time measurements lie, first, in the accuracy with which the conditions surrounding the operations (the job data) are standardized, and secondly, in the thoroughness with which the job data are interpreted by drawing, instruction card, etc., and then put into records as guides for future practice.

REVIEW

After a standard performance has been set, how can the laborers be held to their task?

What similarity is there between the work of the rate-fixer in an office and that of a grader of cotton?

What opposition would you expect to meet from a trade-union if you tried to introduce a new system of wage payment based on time-studies?

What bad effects generally follow an employer's cut in piece-rates?

Give a brief résumé of the history of wage systems, showing how the modern scientific method has been evolved gradually.

How did Mr. Taylor divide the function of time-study?

What safeguards should be kept in mind in order to prevent ill-judged time measurements?

CHAPTER XVIII

WAGE SYSTEMS

1. *Systems of pay.*—The most prominent systems of pay in the United States are the day-work plan, the piecework plan, and various modifications of the premium or bonus plans.

The first method is usually employed where special conditions prevail. Thus, it would be fatal to adopt a system of wages in a department where great care and accuracy were demanded if the system stimulated the workmen to produce more but inferior work.

The piecework system provides for the payment of work by the piece. It was at first hailed with enthusiasm by the worker, but so many abuses which proved hurtful to the pieceworker, crept into the system that the latter now generally regards it with suspicion. One of the abuses is the practice of cutting rates when the men begin to earn high wages. The mischief is very largely caused by poor judgment in the establishment of the piece-rate in the first place. Neither the standard prices nor the standard times were based upon scientifically determined data, but upon some such basis as the "best previous records," an "ordinary try-out," or the foreman's estimate. The laborer generally saw that by working harder he could increase his income by several per cent, but this gener-

ally led to a corresponding cut in the price. Thus the laborer was obliged to work very much harder than a few days before, for a return in wages no larger than formerly.

2. *The premium or bonus system.*—With the day-work plan and the piecework system as a basis, other methods have been made possible by the more accurate determination of standard times. The premium, or bonus system is one which sets a definite time for the accomplishing of a task, and which provides for the payment of an extra sum of money if the work is completed within this time. This is a modification of the day-work plan, whereby a definite task has been more scientifically determined in regard to the time necessary to accomplish it. The principle involved in this system, as in the other, is to establish a fixed rate of pay per day, so that if the laborer turns out less work than is demanded by this standard he will be insured at least a living wage. On the other hand, if he attains the standard set, or exceeds it, he will be paid a proportionately larger wage.

3. *The Halsey system.*—The Halsey system, named after its inventor, is an example of a wage system formulated along these lines.

A standard time is set for accomplishing a task but if for some cause beyond the control of the workman that piece of work cannot be done in the time set, the laborer gets the wage previously agreed upon. It is also understood that this rate of wages will not be cut. Suppose that the man were working on a six-

hour-day basis, he would be expected to finish in six hours, and if he did, would be paid 25 cents an hour, or \$1.50 a day. If he did the work in five hours he would get a part of the wages which he had saved by finishing an hour sooner. If the proportion agreed upon were one-half, he would then get \$1.37½ for the five hours' work—namely, five hours' work at 25 cents, plus 12½ cents for the hour he saved. If he did the work in three hours he would get three times 25 cents, plus one-half of the wages for the time saved, or \$1.12½.

Under this system, therefore, the laborer never fell below the day-rate that was fixed, and he always had the chance of earning more by turning out more work. This was a compromise between the day-work and the piecework system which lessened the effects of each. The employer received part of the benefit of the employee's increased output; thus his temptation to cut the laborer's wages was eliminated. On the other hand, the workman would not be inclined to limit his output because he wished to do as little work as possible as under the day-work plan, or for fear that his wages would be cut, which so frequently happens under the piecework system.

4. *Taylor differential system.*—Another system is that known as the Taylor differential piece-rate system, also named after its inventor. This is based on an accurately determined standard time, a careful study having been made of the operations involved and of estimates of how long it would take a first-class

man to accomplish a given piece of work. If that standard is reached, the workman receives a high rate of wages. If he just falls short of the standard set, a considerable deduction from the day-rate is made.

For example, suppose twenty units or pieces to be the largest amount of work of a kind that can be done in a day. If a workman finishes 20 pieces and all are perfect, and he receives 15 cents per piece, his pay will be 15×20 , or \$3. If, however, he turns out only 19 pieces, then he is allowed a proportionately lower price, say 12 cents per piece, and his pay for the day will be 12×19 or \$2.28. If he succeeds in completing 20 pieces, some of which are imperfect, then he is given a still lower rate of pay, say 10 cents, or even 5 cents per piece, according to the circumstances. Thus, while incompetence is heavily penalized, carelessness is still more severely dealt with. This is only another of the special plans made to suit particular conditions. It could be introduced into only high-grade shops, where the work is standardized and the men are trained by functional foremen. It might be applied where the intensity or the rate of production must be high in order to get the utmost out of the very costly machinery, tools and so on.

5. *Efficiency system.*—The efficiency system is still another of these methods of wage payment. Here the time limit is set, as in the Taylor system, and if the workman fulfils the requirements he receives a large bonus; that is, the employe is paid by day wages, but is stimulated by an additional bonus proportioned to

his efficiency—efficiency in this sense being the ratio between the time he takes for the job and the standard or schedule time set for him. The amount of the bonus is determined by a standard table which fixes the percentages of wages, for time actually worked, that is paid in addition as bonus at any determined rate of efficiency. As applied in the Santa Fé shops, this system grants no bonus for work below $66\frac{2}{3}$ per cent efficiency—that is, below the rate of working at which the man takes $1\frac{1}{2}$ the standard time for completing his job; from that point upward, it allows bonus on a rising scale, which reaches 20 per cent in addition to actual wages at 100 per cent efficiency (or the completion of the job in the standard time). Thereafter it adds 1 per cent of wages for each additional 1 per cent of efficiency.

6. *Comparison of Emerson and Taylor wage plans.*—Thus it is seen that this system does not punish a man for not reaching a standard and obviates the failing of the Taylor system by enabling the men to earn a fair wage even if unforeseen difficulties occur. For instance, if a man reaches 100 per cent efficiency, he receives a 20 per cent bonus; if he falls below or goes above this standard, he receives less or more, according to the following table:

Efficiency	Percentage of Additional pay
67%	0
74%	1
80%	3.37
85%	6.17
90%	9.91

Efficiency	Percentage of Additional pay
95%	14.53
100%	20
110%	30
120%	40

7. *Comparison of three fundamental rates.*—That the three rates of payment may be compared the more easily, the following table has been prepared in which each system has been reduced to a time payment basis:

Hours, work	Day's Work		Piecework		Premium	
	Daily Wages	Hourly Rate	Daily Wages	Hourly Rate	Daily Wages	Hourly Rate
7	\$1.75	.25	\$1.50	.214	\$1.75	.25
6	1.50	.25	1.50	.25	1.50	.25
5	1.25	.25	1.50	.30	1.375	.275
4	1.00	.25	1.50	.375	1.25	.312
3	.75	.25	1.50	.50	1.125	.37
2	.50	.25	1.50	.75	1.00	.50
1	.25	.25	1.50	1.50	.875	.875

In order to make a further comparison of the various systems, we will assume that the following conditions might occur:

(1) The workman reports at the shop, stays there all day, but is given no work; (2) the workman does the standard work in the standard time; (3) the workman does all the work in a very short time, remains in the shop, but is given no further work.

Then, under the various systems we have mentioned, their pay would be respectively as follows:

	No. 1	No. 2	No. 3
Day-rate.	Full wages.	Full wages.	Full wages.
Piece-rate.	No wages.	Normal pay.	Full pay.
Premium.	Full wages.	Full wages.	50% additional pay.
Taylor.	No pay.	Bonus above normal pay.	Full bonus and full pay.
Efficiency.	Full wages.	Bonus above normal pay.	Full bonus and full pay.

8. *The purpose of time and motion-studies and bonus systems.*—There is no necessary relationship between time-study and premiums. Either might exist without the other in any system. Each has a distinct purpose. A straight piece-rate system may be based on accurate time and motion-studies, and may prove very satisfactory to both management and men; while a piece-rate plan involving a large bonus may be equally disappointing to all concerned. Time and motion-studies should determine the amount of work that can be done in a day. In short, they should establish the basis of a fair day's work, and hence a fair day's pay. The premium element in the system may serve simply as a means of distributing the wage, but its real purpose is to stimulate the worker to greater and better production. Its most important result is the stimulus that it gives to human endeavor; while affording the basis of a just reward it furnishes a prize to be won.

9. *Simple bonus plan without time-study.*—Where past records have been taken as a basis of a wage rate in combination with a simple bonus, the minimum of workingmen's resistance has resulted. The bonus plan of payment as combined with methods that determine accurately the shortest time in which a job can be finished, has much to recommend it. In the first place, it is readily understood and can therefore be easily introduced among a body of laborers. It is easily adapted in some form to almost any other system of pay that may already be in existence in the

shop. Some managers have found it advisable to extend the bonus plan so as to include the job bosses and the foremen. The plan in this case is to give bonuses to the foremen if all the men under them earn bonuses. This has the advantage of stimulating the foremen to give immediate and close attention to the inefficient workman. They will either attempt by proper and speedy training to raise such a man's efficiency, or drop him from the payroll.

Thus from the point of view of labor the great purpose of standardizing, as to both operations and time, is to introduce some system of wages whereby efficiency is increased and stimulated by means of bonus awards.

Perhaps the greatest discovery which the modern manager has made in his studies and attempts to solve his labor problems thru better wage systems, is the fact that the efficiency of the whole organization is the efficiency of the individual workman, and that the efficiency of the latter is secured and increased by giving him a wage proportioned to his production.

REVIEW

Point out the distinction between a premium system that has the daywork plan as a basis, and a premium system that has the piecework plan as a basis.

Which wage system is based upon the most accurate data, the Halsey system or the Taylor system?

If you were manager of a high-grade shop where the work is standardized and the men well-trained, which system of wage payment would you favor and why?

Employer and employe are continually making demands upon each other that are based on the argument of a fair day's work and a fair day's pay. What do these terms mean?

CHAPTER XIX

CONTROL OF LABOR—SELECTION AND TRAINING

1. *Selecting the "right stripe."*—The employer of labor is inclined to select men for their qualities rather than for their experience. If an applicant has ability and willingness to work he can be taught what to do; whereas laziness, dishonesty or wrong prejudices will inhibit the best results of experience.

In determining an applicant's fitness, every employer of labor should have certain standards to guide him in selection. These standards should involve an understanding of the requirements of the situation; a knowledge of the aptitudes, abilities, interests, ambitions, resources and limitations of the applicant; and a careful consideration of the relationships of these two groups of facts.

2. *Methods used by Chalmers and Taylor.*—In view of the importance which the average employer attaches to experience, the following lists are very significant. One comes from an expert in the selling field, Mr. Hugh Chalmers, president of the Chalmers Motor Company; the other, from an authority in production, Mr. F. W. Taylor. Not more than one quality in each list refers to experience or business training. All the others are inherent.

HUGH CHALMERS

1. Health.
2. Honesty.
3. Ability.
4. Initiative.
5. Knowledge of business.
6. Tact.
7. Industry.
8. Open-mindedness.
9. Sincerity.
10. Enthusiasm.

F. W. TAYLOR

1. Health.
2. Honesty.
3. Brains.
4. Grit.
5. Special knowledge, manual dexterity or strength.
6. Tact.
7. Energy.
8. Judgment.
9. Education.

3. *Aid gained from a written list.*—The employer may be greatly helped in choosing his men if he makes out a similar list of the prime characteristics which his own experience has shown him to be necessary in the men who are employed in his business. With this list before him he can mentally check up the applicant and feel sure that he has not let some essential slip by

unnoticed. Mr. Chalmers' testimony may be helpful along this line:

When I was working as a salesman myself I was always trying to analyze successful men to find out the reason for their success. Later when I became sales manager and had to employ, train, and supervise men, I had these (ten) requisites put on a blackboard in my office, and I used them for measuring men, for discovering their weak spots, and I have always found them very helpful.

4. *Make a man analyze himself.*—Besides the information which a manager of labor gathers from observation, there is much benefit to be gained if he can induce the applicant to carry on a proper self-analysis. Altho the man's estimation of himself may be wrong, nevertheless the manager will see the problem from a different angle by means of this procedure, and many a characteristic will disclose itself, even where the applicant has attempted to cover it up. The following questions prepared by Mr. Gustav A. Blumenthal are suggestive of what may be done along this line:

Where born?
 Is father living? His occupation?
 Is your health good? If not, what is your trouble?

 What exercise do you take?

 Are you fond of sports? If so, which?

 What schooling have you had?

 What are your favorite studies?
 In what studies are you weak?

What kind of reading have you done?.....
Are you following a definite line of reading or study now?
..... If so, what?.....
Do you sing?..... Play on any instrument?.....
Have you a hobby?..... If so, what?.....
Does your mind concentrate, or skip from one thought to
another?
Have you self-confidence?..... Patience?.....
Are you inclined to be lazy?.... Do you act impulsively?...
Do you make friends easily?.... Are you fond of company?
..... Are you sensitive?..... Are you inclined to think
yourself misunderstood?.....
How do you spend your leisure time?.....
.....
What are your pleasures?.....
What habits or vices do you have to fight down in yourself?
.....
Are your thoughts clean?.... Can you trust yourself?.....
Do you consider yourself absolutely honest?.....
Trustworthy?..... Conscientious?.....
What is your religion?.....
Are you a church member?.....
Are you self-supporting?..... Can you save money?.....
How many depend upon you for support?.....
Indicate the different occupations you have followed:
Occupation: How long in it? How did you like it?
.....
.....
.....
.....
What life do you think you would prefer?.....
What training or special fitness have you had for this work?
.....
What is your present occupation?
Do you like it?..... Why?.....
Do you aspire to be an employer of men?.....

What is your greatest ambition?.....

Are you willing to pay the price in hard work to attain success?

When the applicant has filled out the above blank the employer may classify the information under the following headings: mental characteristics; physical characteristics; moral and social characteristics; abilities and talents; vocation in which success may be reasonably expected; courses of study and hobby advisable.

5. *Use of written and oral tests.*—The oldest method of determining fitness is the written or oral examination, but little use has been made of it in the business world. The Chicago and Northwestern Railway, however, has a system of progressive examinations running thru three years.

Each fireman when he is employed is given the first year's book of questions, the company's book of rules and a time-card. As soon as convenient after the expiration of his first year's service, he is given a written examination by the traveling engineer or traveling fireman, who also examines him orally. If successful in passing this test, he is given the second year's book of questions, upon which he is examined a year from that time in the same manner. At the end of his third year the fireman is examined by a joint board of examiners appointed for the whole system;

this board sits in Chicago each spring and fall. Some of the traveling engineers and the airbrake instructors compose this board, and their favorable report makes the man eligible to promotion to the position of engineer whenever he is needed on his own division.

The failure to pass any one of these progressive examinations results in a second trial six months later; two successive failures drop a man from the locomotive service at once. No man is permitted to waive his right to promotion.

6. *Testing for physical and moral fitness.*—Little need be said about the necessity for discovering a man's physical and moral qualities. The methods employed in obtaining data for physical fitness lie largely in the province of the physician, and many business houses employ physicians for this purpose. But the testing for moral qualities is a comparatively new feature in business management. The usual procedure is to "size up a man," but so many mistakes are likely to happen in using surface appearances as the basis of judgment that business men are today demanding a more intimate analysis of their employes' characters. They are beginning to recognize that the most desirable qualities, such as conscientiousness and loyalty, are less in evidence than initiative and polish, and that, moreover, while good clerks and mechanics may possess all of these qualities, they may lack the knack of personal salesmanship.

Difficult as it is, the problem of placing the right man in the right place is being successfully solved for

continually increasing numbers of men and women.

7. *Control by education.*—Business managements, like political governments, are coming to realize that the basis of control must in the end be education. The tendency to adopt this point of view is indicated by the following examples:

The New York Edison Company offers educational facilities thru its Educational Bureau and the Educational Committee of the Association of Employees. The committee prepares technical and accounting courses, in which the attendance is voluntary. The Educational Bureau prepares the commercial courses and part of the routine work of the commercial department, and instruction is given on the company's time.

The commercial courses include hygiene, health and recreation; the basic principles of salesmanship; company organization; the elements of central station business-getting; and the fundamental principles of electricity. The school staff consists of a manager, an instructor in charge and a secretary. The term begins in October and closes in May. The work covers two years.

The technical courses consist of laboratory exercises, preceded by a talk in which the instructor outlines the work briefly. Students are rated on their work. Prizes are given to those who attain the highest standing. The course lasts fifteen weeks each year—five evenings and one afternoon each week. The accounting course was offered for the first time

during the year 1912-13. It consists of a series of lectures by a professional teacher. Besides these courses, the company has lectures, given by their officials or by prominent speakers, on general and public policy, etc., and on technical subjects.

The Metropolitan Life Insurance Company gives a course in business English. It consists of thirty weekly lessons in grammar, composition and business letter writing. A fee of \$3 is charged. There are also classes in stenography and typewriting. The company maintains a circulating library of general literature, science, etc. In July, 1912, there were 6,729 books and pamphlets for the use of the employees. The total membership of the library is 2,605. There is an average daily circulation of 107 books. A trained librarian and three assistants are in charge.

The National Metal Trades Association is lending its support to institutions that are teaching courses on industrial subjects. For instance, in Chicago it cooperates with the Lewis Institute; in Cincinnati, with the Continuation School and Cooperative High School, as well as with the University; and in Cleveland, with the Technical High School and the Young men's Christian Association.

In Hartford, Conn., the public school authorities have started a continuation school to which the members of the Metal Trades Association send their apprentices. In St. Louis, members are working with the Rankin Trade School, where the apprentices are making gratifying progress. In Indianapolis, a

committee of the association equipped with machinery certain buildings of the Winona Technical Institute, and furnished scholarships of the value of \$100 each for prospective students. The committee solicited contributions of equipment and scholarships from members of the Metal Trades Association.

The American Bankers' Association has a branch called the American Institute of Banking. Its purpose is to educate bankers in their special lines, to maintain a standard of education by official examinations, and to issue certificates for the accomplishment of certain work. It has 12,000 members, organized into 75 chapters in the principal cities of the country and in Cuba and Hawaii. Employes of country banks are enrolled as correspondence students. The course of study covers the theory and practice of banking and allied principles of law and economics. The course requires at least 100 hours of class and correspondence work under approved teachers.

Spencer Trask and Company of New York City, one of the largest bond-investment houses in New York, gives a course of instruction covering financial organization. This firm requires its employes to study corporation finance, foreign exchange, the money market, theory of investments, and to analyze current security fluctuations, speculation and the stock market. Their men are also required to pass examinations on political economy, money and credit, and the principles of salesmanship.

The National City Bank of New York provides

classes in business correspondence, French, German, Spanish, penmanship, commercial arithmetic and bookkeeping. These are given as a first-year course; a more advanced course is outlined for a second year of study.

8. *Special training for the company's work.*—Some firms try to give their employes specific training for their own work. Classes are held during work hours or in the evenings. They are supplemented by lectures on such vital subjects as hygiene, sanitation, diet, first aid to the injured, and the like. The National Cash Register Company has an agents' school for salesmen, one for advertising men, one for officers for the study of business management, and others for foremen, janitors and waiters. The company has a kindergarten for the children of its employes, and conducts cooking, sewing and millinery classes. It realizes that any training that benefits the home makes better workers. The Heinz Company has cooking and sewing classes for its seven hundred girls, most of whom are immigrants. The Charles William Stores in Brooklyn instructs their salesmen and other employes, and provides lectures for the foremen. Many companies provide libraries and reading rooms, with technical literature, popular fiction and magazines.

9. *Manuals as an educational factor.*—Some firms distribute manuals describing the details of their work. One corporation publishes a two-hundred-page book with cuts and reports, and gives one to each employe, who is supposed to read it all, with special attention to

the parts pertaining to his work. Quizzes are held frequently, and those who are deficient in any subject are dismissed. The publication of the book costs \$2,000 but the company considers the money well invested. Each new man must read the manual so as to get a general understanding of the whole system. The effect has been good in lessening mistakes among both old and new workers. This system makes it easier for the various departments to work together harmoniously. Each person knows why he is doing certain things, and as a consequence has much more interest in his work and greater enthusiasm. He also has some comprehension of the part his work plays in the whole organization.

10. *Special training schools for employes.*—Many organizations recognize the value of giving employes preliminary training for their work. Some find it worth while to broaden the employes' knowledge of the business as a whole, while a smaller number are far-sighted enough to accept responsibility for aiding their employes to fit themselves thru courses of study for advancement, altho the courses that are given may apparently have but slight bearing upon the immediate earning power of the employes.

The methods by which this special training is given differ greatly among corporations. However, if we select the main features of these training schools, it is found that such institutions may be classified under three types as follows:

(a) Company business school. In the type known

as the company business school, the subjects taught and the training given are related directly to the work of a particular company. The type can be subdivided into three groups of schools, according to the methods that are followed.

The first group is directly connected with those corporations that expect the student-employee to give all his time to study while he is taking the course; they do not, therefore, expect him to do productive work while he is in training. Such a school expects to get definite results with the least possible loss of time; it is organized to accommodate two classes of employees, i.e., new employees and old employees. This principle applies as well to the second and third groups below.

The second group embraces those companies which combine practice-work with study and which are only partly productive.

The third group confines its efforts to work courses alone. In this kind of school the students are doing productive labor continually.

(b) Company continuation school. The second main class of schools, the company continuation school, altho typically German, is gradually working its way into our system of vocational education. Its motto is "Learn while earning."

In contrast with the rigid methods employed by the first type in the selection of students, we find few restrictions here. The company continuation school is marked by a somewhat broader educational outlook than that of the company business school. Accord-

ingly, we find classes in English, mathematics, history, civics, geography, spelling, hygiene, typewriting, shorthand, sewing and dressmaking. These are all in addition to a number of other subjects, directly related to specific occupations, such as engineering, drafting, machine operation, printing, office work, telephone operation and salesmanship.

Of this kind there are two groups, those schools conducting evening classes, and those holding day sessions. The methods of instruction are as varied as the subjects taught. Many corporations, however, use only the correspondence method.

(c) Public or private continuation school. The third main type, the public or private continuation school, is cooperative in its nature and is similar to the first type, second group, in that the instruction involves both study and practice. The study is done, however, at the public school and under its direction, instead of being done with the company. This method necessitates cooperation between the business organization and the public school, but its practicability is proved by the increase in the number of firms that are using it.

11. *Education for the whole industry.*—The standardization of the methods and materials of education for each industry is growing year by year. The various industries are attacking their work in different ways. This variety of method may be illustrated by reference to the department stores and the gas companies of the United States.

The department stores, as a rule, are working independently of one another in their educational endeavors. Strawbridge and Clothier of Philadelphia has developed a system with reference to its own problems, and Stern Brothers of New York is solving its difficulties by means of its own special methods. Perhaps the appearance of the Department Store Education Association of New York City shows that the educational work of this big industry will be studied along the more economical lines by all the leading stores that are cooperating in the movement. One of the most thoro and systematic department store schools is that conducted by Stern Brothers. This school, working in harmony with the Department Store Education Association, divides its work into three branches: (1) store system and salesmanship, (2) merchandise (textiles and textile processes), (3) merchandise (non-textiles, leather, rubber, paper, pottery and glass). Classes are held on company time and the instruction is in the hands of a director and two assistants. Diplomas are given to those who complete a course. That the employes appreciate this work is clearly shown in the organization of an alumni society and the adoption by its members of a special badge. Not only is increased selling efficiency observable as a product of this system, but also a growing esprit de corps which before was lacking.

12. *The work of the National Commercial Gas Association.*—In contrast with the methods of the department stores, there are those of the gas companies,

which have attacked their educational problem thru their national organization. As a consequence, the educational material for the commercial men in the gas companies is uniform thruout the industry. Over eight thousand men have already taken advantage of the opportunities offered. While the work is based on the correspondence method, individual gas companies, such as the Public Service Gas Company of New Jersey, the United Gas Improvement Company of Philadelphia, and the Consolidated Gas Company of New York, Brooklyn and Baltimore, have special well-organized classes under paid instructors, for carrying on the work. Since the gas companies have carried this kind of work the furthest, the following program is given below:

Introductory Division, LESSONS, Manufacture of Gas—Distribution of Gas—Generation of Electrical Energy—Transmission and Distribution of Electrical Energy. REFERENCE PAPERS, Arithmetic—Business English—Chemistry—Properties of Matter—Elementary Magnetism—Elementary Electricity—Elementary Mechanics—Algebra—Geometry—Heat—Generation of Electrical Energy—Light—Sound. SIDE TALKS, General Suggestions and How to Study—Arithmetic—Business English—Manufacture of Gas.

Course 1, INDUSTRIAL FUEL AND POWER, Principles of Heat—Transfer of Heat and High Temperature Measurement—Combustion and Selection of a Fuel—Blast-Burner Design—Air Blast—Refractories and Insulation Steel—Heat Treatment of Carbon Steels—Heat Treatment of High Speed Steels—Surface Combustion—Principles of Power Engineering—The Gas Engine—Steam—Factors Governing Efficiencies of Appliances—Application of Industrial Gas to the Treatment of Materials—Industrial Illuminating

Engineering—Competitors of Industrial Gas (The Industrial Fuel Information Books will be incorporated in these lessons and issued from time to time).

Course 2, ILLUMINATION, History of Illumination—Units of Light and Illumination—Graphical Methods of Presenting Data—Photometry—Measurement of Light—Production of Light—Requirements of Illumination—Residence Lighting—Church Lighting—Office Lighting—Factory Lighting—Industrial Lighting—Store Lighting—Street Lighting.

Course 3, SALESMANSHIP, General Sales Problems—Water-Heating Circulating Types—Air-Heating Systems (Gas)—Hotel and Restaurant Appliances—Water-Heating, Automatic, Storage, and Instantaneous—Domestic Science and Its Appliance to Selling Gas—Hygienic Value of Using General Gas Appliances—Advertising—Window Decoration—Domestic Cooking Appliances—All-Gas Kitchens—Accessory Cooking Appliances—Domestic Lighting—Commercial Lighting—Industrial Lighting—Public Lighting—The Law of Contracts—Agencies—Friendly Relations with Plumbers, Dealers, etc.—Architecture and Engineering.

Course 4, COMMERCIAL MANAGEMENT, Analysis of Territory—Plan of Work—Office Organization and Practice—Filing Systems—Sales Organization—Company Policy—Choosing, Training and Holding Men—Methods of Compensation—Purchasing—How to Advertise—Selling Aids, Advertising Talks—Details of Laying Out Advertising Space—Special Selling Campaigns—Service Requirements—Maintenance—Relations with Manufacturers—Sales Managers' Reports—Graphic Charts, Budgets, etc.—How to Analyze Merchandising Accounts—Collection and Credit—Public Utilities.

Course 5, ACCOUNTING, General Principles of Accounting—Books of Original Entry—Financial Statements—Balance Sheet or Inditant Accounts—Income Accounts—Organization of a Gas Company—Acquisition of Fixed Assets—Departmental Organization of the Company—Beginning of Operations. First Month—Sales of Gas, By-Products, Appli-

ances, etc. First Month—Cost of Administering, Financing, etc. First Month—The Trial Balance—Accounting Transactions for Five Months—Closing the Books. First Six Months' Period—The Reorganization—Control by Public Service Commissions—Branch Accounting and Auditing.

Extended Course 5, ACCOUNTING. This course will cover the same subjects that are given in Course 5. In addition, however, lessons on Public Utilities will be given, including: Management—Financing—Organization—Operating—Interdepartmental Relations—Public Relations.

A lesson in Business English is given with each lesson thruout the entire course.

Lesson papers and test questions are mailed at intervals of one month, except during July and August.

Test questions are sent with each lesson paper. The questions can be answered after a study of the lesson paper.

The reference papers are intended for reference use only, and the student need not attempt to master them as he would the lesson papers.

The test questions are graded at the headquarters of the Association and returned to the students with corrections and suggestions.

Each course consists of two and a half years' instruction, and a diploma will be awarded at the end of that time to all students who have answered the test questions to the satisfaction of the Board of Educational Control.

The educational work is divided into three divisions or periods: **FIRST PERIOD**, consisting of the Introductory Division; **SECOND PERIOD**, consisting of the first ten lessons in each specialized course; **THIRD PERIOD**, consisting of the remaining lessons of the specialized course.

Many of the corporations just mentioned, as well as hundreds of other companies, are also cooperating in the work of the Alexander Hamilton Institute, which need not be here described.

REVIEW

What advantage does an employer of labor gain if he can get the applicant for a position to analyze himself?

What are the moral effects of a system of labor management that provides periodical tests of the ability of the workers and does not permit a man to waive his right to promotion?

How would you provide for an employee who has studied and worked hard to master his position, but who has not materially increased his output?

An employee has followed the courses of instruction provided by the firm and has succeeded in proving himself to be a \$2,000 man instead of a \$1,000 man. There is no place open for him in the way of advancement. What would you advise in his case?

CHAPTER XX

CONTROL OF LABOR—WAGES, RECORDS AND PROMOTIONS

1. *High cost of man-power.*—The difference between the costs of man-power and of machine power is tremendous. Large electric-power companies quote prices of 10 cents to 2 cents per kilowatt hour; and prices as low as 0.5 cents have been known where electric current was used in very large quantities.

A man-power has been estimated to be equal to about one-tenth of a horse-power. On the basis that a kilowatt is 1.34 horse-power, and that labor is paid 15 cents an hour, it is figured by a prominent engineer that human physical force is from 20.1 to 100.5 times as expensive as electro-motive force—the force in each case being purchased from the generator.

The most significant factor in the development of the American nation, whether we look at the subject from the political, religious, social or economic side is the high cost of man-power. No nation is likely to advance with equal rapidity along all lines at once, for that element in a nation's life matures most quickly which calls to it the strongest men. Business, therefore, in America has been able to overshadow other callings because it could pay the price.

As a converse proposition, it might be stated that business can pay the price because it has drawn to itself the highest type of man-power, the intellect of men. Thinkers and leaders in the economic world have seen the advantages of replacing, where possible, the high-priced physical human labor by the cheaper natural forces. Thus business itself has been modified from within by the same force which made it the leading factor in our civilization; the high cost of man-power has compelled business men to use steam, electricity and water-power. Few managers today need to be told that the most efficient way to utilize man's physical strength is to employ it in the control of machinery by which the work is actually performed. The locomotive engineer or the man who manipulates the many-tonned trip-hammer, controls forces thousands of times greater than he himself could exert.

But there comes a time in all progress when the advancement in a particular direction is retarded and when every gain is made at greater and greater cost. This is the case at present in the basic industries. Every machine needs a man to tend it, and thus there is a point below which the substitution of machinery for men cannot go. Realizing this, a few progressive managers are looking in new directions for the saving of this high-priced man-power, or at least for the more economical use of it.

2. *Waste of human power.*—When the chief concern of the manager was to get out his product, no

matter what its quality, of what use was it to speak of a science of labor control? He needed men—the stronger the better. The industrial frontier was advancing by leaps and bounds, and men were needed. Any kind would do. The manager seldom questioned closely to see whether an applicant was “the man for the job” when he employed him; and when he dismissed an employe he assumed that the man’s failure was due to general incompetence. That the workman might simply be a “misfit” never occurred to the manager.

The frontier days of business are gone. “Big killings,” with primitive methods, are now as scarce in business as in hunting. It is time that some of the energy of investigations be turned upon the question of labor adjustment—the more economical use of human power. Consider the efforts of our schools, colleges and private laboratories to solve questions pertaining to mechanical and electrical engineering; the striving to produce mechanical refinements and power-saving appliances; the tests of coal, oil and other fuels; the gauges for measuring the use of power—and then consider the small amount of effort used in investigating the use and conservation of labor power!

Some years ago, late in 1907, in a very large machine shop we utilized the month of shut-down, when 90% of the employes had been laid off, to relocate 75% of the machines so as to facilitate, expedite, and cheapen production. Nothing was done as to personnel, altho it is obvious that an organ-

izing skill that could instal in poor locations three-quarters of the machines, would also, to at least some extent, fill the personal positions badly; and so it proved, for when business started up again there were a succession of demoralizing and costly strikes.

Investigation shows that in most industrial plants at least three-quarters of the men are badly placed, which does not in the least mean that the men are undesirable. An intelligent readjustment and reassignment of positions without discharge may improve the efficiency of a plant 30% to 40%.

Efficiency tests and analyses, tests of operation, not of organization, always show, among the day wage-earners in the same plant, individual variations between 30% and 120%; the extremes of actual test on a whole month's work being 7% and 210%. The 210% man was evidently, by accident or choice, extremely well-fitted to his work; the 7% man was equally, by accident or choice, extremely poorly fitted to his work. Operation can gradually, in the course of months and years, eliminate men of low efficiency, and by experiment and test and successive discharges replace them with men of higher efficiency. In this way it is possible in the course of three or four years to bring the efficiency of operation up from 50% to 100%, but as an element in organization it is possible by predetermination of aptitudes to curtail the time very greatly and in the end secure a better personnel.¹

3. *Periods of rest and relaxation.*—While it is true that experiments have shown that a man-power is equivalent to about one-tenth of a horse-power, there are elements in labor power that do not need to be considered in determining mechanical efficiency. A man is spending his own energy, first for himself, and then indirectly for the benefit of the manager. When a man reaches the fatigue point, the consequences of

¹ Harrington Emerson, in address before the Efficiency Society, annual meeting, 1913.

continued labor are something more than slackened production; he is robbing himself of his health—the storage battery of his working power. It is at this point that employers of labor need more knowledge of the relationship which should exist between the periods of rest and relaxation for “different volumes of load” carried by the laborers. They should be able to see how to adjust these periods in the predetermination of industrial operations so as to obtain the maximum of work without exceeding the “elastic limit” of the employe. It was along this line that Mr. F. W. Taylor conducted some of his most important investigations. He not only recognized that the working-time units must be separated from the resting-time units, but he was the first to point out that the different kinds of work require different percentages of rest, according to the kind and nature of the work done.

Altho little work has as yet been done along this line, there are evidences of much interest in the determination of a fair day's work. Time studies, fatigue studies, work records, etc., are growing quite common, and their results all bear on the determination of a fair day's work.

4. *A fair day's pay.*—Closely associated with the problem of a fair day's work is the question of a fair day's pay. They are the two sides of the same shield. The employer sees one side; the employe the other. It will, however, be a comparatively simple thing to determine a fair wage when we know how to estimate

the labor involved. Yet there are other elements to be considered besides the amount of energy expended by the laborer, and the rate per day that he is paid by the manager. These are (1) steadiness of employment, (2) permanency of employment and (3) future prospects.

Altho American business men proved to the world that high wages do not necessarily mean high costs of production, it seems difficult for many employers to see the application of this principle when they are brought face to face with the question of labor costs in their own store or factory. They see the "wages paid" but forget the "output." "Wages paid" are high or low, according to the size of the output; "wages received" are high or low, in proportion to the time which the laborer takes to do the work. The combination of low wages given with high wages received would prove to be ideal.

5. *Illustrations.*—CASE I: Assume that a workman turns out ten units of a given product, for which he is paid \$3 a day. The upkeep, interest and depreciation of his machine amount to \$6 a day. The factory overhead cost, distributed to either the man or the machine, is \$1.50 a day. The material required for the ten units costs \$7.50. While this is purely a supposition, the proportions are typical. The cost is \$1.80 for each piece. In the form of a simple equation the results work out as follows:

$$\begin{array}{rccccccccc} \text{Labor} & + & \text{Machine} & + & \text{Overhead} & + & \text{Material} & = & \text{Cost} \\ \$3.00 & + & \$6.00 & + & \$1.50 & + & \$7.50 & = & \$1.80 \\ \frac{}{10} & + & \frac{}{10} & + & \frac{}{10} & + & & & \end{array}$$

This equals a piece-rate of 30 cents of wages to the workman. If the employe can be induced to increase his output, the more he makes the cheaper becomes the cost.

CASE II: If the workman earns \$4.50 by increasing his output by one-half, the cost per unit of product drops to \$1.55.

$$\begin{array}{l} \text{Labor} + \text{Machine} + \text{Overhead} + \text{Material} = \text{Cost} \\ \$0.30 + \frac{\$6.00}{15} + \frac{\$1.50}{15} + \$0.75 = \$1.55 \end{array}$$

CASE III: If he earns \$6 by doubling his output, the cost drops to \$1.42½.

$$\begin{array}{l} \text{Labor} + \text{Machine} + \text{Overhead} + \text{Material} = \text{Cost} \\ \$0.30 + \frac{\$6.00}{20} + \frac{\$1.50}{20} + \$0.75 = \$1.42\frac{1}{2} \end{array}$$

CASE IV: If, however, the employe cannot be induced to exert himself, except by means of a higher piece-rate, say 35 cents for each piece, it will still be real economy to allow the increase. Tho the workman would earn the high wages of \$5.25 and \$7 per day, the original cost of \$1.80 would fall to \$1.60 with the lower, and \$1.47½ with the higher earnings.

CASE V: Suppose, in Cases II and III, that in order to increase the output 50 per cent it is necessary to increase the office force and to supply storeroom clerks, etc. This makes the overhead rise to \$2 a day. The cost would, nevertheless, drop to \$1.63½ in Case II, and \$1.50 in Case III.

$$\begin{array}{l} \text{Labor} + \text{Machine} + \text{Overhead} + \text{Material} = \text{Cost} \\ \$0.35 + \frac{\$6.00}{15} + \frac{\$2.00}{15} + \$0.75 = \$1.63\frac{1}{2} \\ \$0.35 + \frac{\$6.00}{20} + \frac{\$2.00}{20} + \$0.75 = \$1.50 \end{array}$$

If, however, which is the more probable supposition, the rate should be made 25 cents instead of 35 cents the saving would become even more marked.

$$\begin{aligned} \text{Labor} + \text{Machine} + \text{Overhead} + \text{Material} &= \text{Cost} \\ \$0.25 + \frac{\$6.00}{15} + \frac{\$2.00}{15} + \$0.75 &= \$1.53\frac{1}{3} \\ \$0.25 + \frac{\$6.00}{20} + \frac{\$2.00}{20} + \$0.75 &= \$1.40 \end{aligned}$$

CASE VI: Or suppose a bonus system is adopted; the man continues at \$3 a day, but is allowed 50 per cent of the time that he saves, as a bonus. This distributes the cost as follows:

Illustration (a) where there is a 50 per cent increase in output.

$$\begin{aligned} \text{Labor} + \text{Machine} + \text{Overhead} + \text{Material} &= \text{Cost} \\ \$0.25 + \$0.40 + \$0.13\frac{1}{3} + \$0.75 &= \$1.53\frac{1}{3} \end{aligned}$$

Illustration (b) where there is a doubled output,

$$\frac{\$3.00 + \$1.50}{20} = \$0.22\frac{1}{2} \text{ per piece.}$$

$$\begin{aligned} \text{Labor} + \text{Machine} + \text{Overhead} + \text{Material} &= \text{Cost} \\ \$0.22\frac{1}{2} + \$0.30 + \$0.10 + \$0.75 &= \$1.37\frac{1}{2} \end{aligned}$$

It will be noticed that the machine and overhead charges are constant, irrespective of output. If a \$3 a day man idles for half an hour the loss is not the 18 cents that he receives, but the $\$7.50 \div 16 = 45$ cents, loss in machine and overhead. If the man is on piece-rate, there is no loss in wages when he slows up, but the machine cost of 45 cents is still there.

6. *Special factors influencing wages.*—The amount of increase of wages over the customary payment necessary to induce a man to appreciate his job and to take care of it, must be found by trial. If it is not ample, the men will decline "to be worked," as they express it, and the plan fails. If it is too much, the

men sometimes become irregular about coming to work, and may fall into habits of dissipation. If the happy medium is attained the workman becomes steadier, lives better and accumulates property. The proper rates of increase given by Mr. F. W. Taylor are:

Light work calling for no special fatigue, such as ordinary shop practice—30 per cent.

Ordinary labor, calling for strength and severe bodily exertion and fatigue—50 to 80 per cent.

Special skill or brains, with close application, but requiring no bodily exertion—70 to 80 per cent.

Skill, brains, close application and extreme rack and bodily exertion, such as are required in running a steam hammer—80 to 100 per cent.

Other industrial engineers agree approximately on these increases, and Mr. Taylor pertinently remarks that they are not quantities to be theorized over by boards of directors, but are facts determined by costly experiments.

The workman is interested in his total day's pay, and not in the unit in which it is figured. The standard illustration of this fact is the case of the ore shovellers at the Bethlehem Steel Works. They were paid 3.2 cents per ton for unloading iron ore from cars. Pittsburgh companies were paying 4.9 cents per ton for the same work. Hearing of this, the Bethlehem gang all quit and went to Pittsburgh. The conditions there, however, were such that they could not maintain their output, and their total earnings fell off.

Within four weeks the entire gang was back at Bethlehem, glad to work at the lower rate, under which their total earnings were greater.

The wage system must be so established that the self-interest of the workman, and the interest of the company will correspond. There should be no confusion of the issue with hypocritical sentiment. Both the employer and the workingman are working for their own interests; and they work together because they can thus best further their own ends. The simplest way to get a man to exert himself is to make it to his personal interest to do so. Each man must be treated as an individual and rewarded in proportion to his individual exertions.

7. *Wages the chief incentive.*—The amount of money paid a man for his work is more important, from the manager's point of view of business policy, than the actual payment which may include many things besides money—for example, free lunches, use of gymnasium, libraries, etc. But the money which a laborer receives is his, to do with as he pleases. It is this bit of absolute possession that appeals to every man. Therefore, it is a wise manager who lets as much as possible of his labor policy show in the wages envelop. It was this knowledge of human nature that led Napoleon to counsel his brother Joseph, "The first thing to be done is to allow no arrears in the pay of your forces." For a manager to institute industrial betterment, medical service, etc., etc., be-

fore he has worked out a satisfactory wage system is simply to waste his efforts.

8. *Importance of short-period records.*—Men love independence, and cash gives it. But having established a working-wage system, it is well to apply all the aids available to stimulate the labor force to high endeavor. Modern psychology is furnishing many suggestions along this line. Among them are two which are worthy of special mention.

Trainers of bicycle riders discovered that the records made when a man was merely riding against time were poorer than when the man was accompanied by a pace-maker. More than that, he showed less exhaustion when making the paced record than when riding more slowly alone. The presence of the pace-maker had this effect. Man needs society in order to do his best work, and if he has some means of comparing his accomplishments at different stages with a known standard, he can call on his reserve forces without the same fatigue which accompanies a solitary performance and a slight knowledge of the progress he is making. The ultimate goal is usually too far away to offer the stimulus necessary to high accomplishment. This principle has been applied by some managers in allowing their bosses to post a record from time to time during the working day, showing each man just what he is accomplishing.

The effect of a record of this kind has been measured in the laboratory upon a university athlete, and it

shows that under this method great gains in endurance are made without evil effects. A college man was set the task of testing the strength of his hand by gripping a contrivance. His first set of performances were completed with absolute exhaustion. Later on, under exactly similar circumstances he was given another test, but now he was provided with a record of each effort showing just how much he exceeded or fell below his previous record at that point. The result showed that this extra stimulation raised his efficiency over $33\frac{1}{2}$ per cent.

The best example in business of capitalizing this spirit of competition or emulation inherent in all men, is seen in Mr. Gilbreth's methods of handling his bricklayers. At regular periods the accomplishment of each man was posted alongside the standard requirements.

9. *Pleasurable surroundings.*—Another psychological factor that plays an important part in the efficiency with which men work, is the element of pleasure. Buoyant spirits and pleasurable thoughts have a decided effect on the physical well-being of man, just as they have upon his temperament. The heart works better and the circulation of the blood is more free, when a man is happy and contented. The basis of good nutrition is laid and health is affected directly.

On the other hand, fear contracts the blood vessels and checks the flow of the blood. The close connection between the mental state and the physical con-

dition is strikingly shown in the slang phrase, "cold feet." Fear lowers the working ability of man. A girl who worked with her back to a passageway beside which her machine stood was about to be discharged because her work was not up to the standard in quality or quantity. The foreman, however, decided to let her remain and to watch her. He found that every time a truck or box was hauled behind her she involuntarily started and slackened her pace. She was placed in a quiet part of the room and there became the most efficient employe in that department.

10. *Chilly surroundings develop fear.*—But if fear causes "cold feet," the reverse of the proposition is just as true. The full effects of warm and hygienic surroundings are not appreciated until the influence which these conditions have upon the minds of the employes is seen. Warmth of body reduces the tendencies to fear and dread. With these gone, suspicion and connivance diminish also. The manager's problem of lessening the number of "discontents" in his factory, shop and office is thus in part solved by making the employes' surroundings pleasant and comfortable.

This solution is not offered as a panacea, but emphasis has been placed upon the point because the influence of industrial betterment upon the efficiency of the worker would be little indeed if it stopped with the physical effects produced upon the bodies of the men, and did not emphasize the mental effects conditioned by them. The man whistling at his work is

more efficient than the same man shivering over his task. The philosophy of industrial betterment rests on the fact that the body and the mind act and react upon each other.

11. *Stimulating self-interest.*—The pay envelop does not draw to itself all the lines of self-interest which determine a man's attitude toward his work. Employes are interested in their records as workmen. If a man does good work he is stimulated to repeat it or to surpass previous efforts, provided he receives due credit. Nothing is more disastrous to individual effort than to elevate the shirk and overlook the industrious man. The management must use some method whereby the individual's work is not merged with that of the mass and lost sight of. But to treat men individually, the work must be carefully allotted and an individual record must be kept. This method has two good effects: (1) it assures the workman of a fair deal; (2) it becomes the means of eliminating poor men. The manager can keep tab on his foreman's appointments, and thus assure the workman that his work is constantly under review in the head office. If the manager or superintendent wishes to take advantage of this system, he can refer to these records and whenever he sees an opportunity to praise an employe he can walk thru the shop or office and by casually greeting the man and referring to the particular praiseworthy accomplishment, he can in time bind all the good men to him in interested loyalty.

12. *Checks against injustice.*—Furthermore, work-

men's records become vital aids in helping to do away with jealousies and injustices attendant on promotions. They force the foremen to depend upon some principle other than consanguinity, the "softsoap grip," or petty tribute, in making promotions. They know that their recommendations must stand the test of recorded efficiency. A manager who suspects his foreman of "playing favorites" can compare his recommendations with the records of other men entitled to consideration. Without removing the foreman's power of promoting a man he can call him to the office and say, "Smith, I understand there is to be a vacancy in your department." "Oh! yes," says Smith. "Well," says Mr. Manager, "we have several good men down there; let us look over their records." Now the manager knows that Smith intended to recommend a worthless cousin for the job. Such an appointment would hurt the discipline of the department as well as cripple its productive efficiency. But he does not want to curtail the power of his foreman. So they look over the record cards of the men. The cousin's record stands out in bold contrast to that of the good men working by his side, who know how incapable he is and that he is related to the boss.

The manager does not counsel his foreman, but the latter knows that he will be held responsible for this appointment. If the foreman were willing to take the responsibility, the manager could not object until the result of the foreman's appointment showed in the record. Smith does not recommend his cousin for the

position, and every man in the department is stimulated to do better work because he feels he is going to be judged by his record and get a fair deal.

13. *Elimination of the unfit.*—The second use to which a record may be put is the gradual elimination of the inefficient and the acquisition of a permanent staff. The record substitutes exact data for impressions and other intangible influences at times when men are to be laid off. On this point Mr. Gantt says:

Some years ago it became necessary to lay off about ten molders in a foundry. The superintendent sent for the record of the men and made up a list of men to be laid off. There was great complaint, in which the foreman joined, that the wrong men had been selected and that some of these men were the best workers in the shop. The superintendent invited an inspection of the records, which the foreman had never been willing to pay any attention to before, with the result that everybody was satisfied and the efficiency of those remaining soon showed a very marked improvement.

14. *A typical case of the use of records.*—It is perhaps natural that the railroads should be foremost in developing systems of discipline for their employes. Slackness in railroad operation may result in fatal accidents, as well as in loss of profits. The old system of discipline by suspension from duty has been quite generally displaced by the system of "discipline by records."

Mr. H. H. Vreeland, when president of the old Metropolitan Street Railway Company of New York City, described this system as applied to his company. Mr. Vreeland stated that in this organization, which

employed 15,000 men, the whole force practically renewed itself every two years before the new methods were adopted. There were not fifty men who had been with the company five years. Division superintendents could discharge men whom they had never seen, and the idea that a man might offer a defense never suggested itself. No account was kept of a man's discharge and he might be hired again in a few days. Soon after the record system was installed improvement in the conduct of the men became marked. They felt in closer touch with the management and knew that each had an equal chance, for they knew that altho their errors were noted, their good work was recorded as well.

15. *Permanency of employment, and pensions.*—The readiness with which a skilled mechanic will sometimes leave his trade, in which he can earn \$5 a day, to enter an office at \$75 per month shows how strong is the influence of permanency in a job. Small companies often compete favorably for labor with bigger firms because they take care of their workingmen during slack times. In some large concerns the power to discharge a man as a matter of discipline is resorted to only in exceptional cases. The Pennsylvania Railroad Company's records show that 1,350 active employes have been with the company forty years or more; and there are 1,013 men who, having served over forty years, have retired on pensions.

So strong has the idea of stability of employment grown of late years that hundreds of big corporations

have adopted some form of pension system. By this means they hope to make the men better satisfied with their work. Many kinds of old-age pensions have been formulated, but the commonest forms are those which provide for the retirement of the employe after a certain period of service in the company, or at a specified age. The amount of the pension is based on a stated percentage of the average income of the recipient, covering a number of years just previous to his retirement multiplied by the number of years of service. Another method, tho less common, is the payment of fixed sums instead of an amount figured on the actual time of service.

The Pennsylvania Railroad Company was the pioneer in establishing a pension system. Their system is the result of an elaborate investigation of the experience of foreign railroad corporations. Several arrangements were considered, and finally the best was adopted. Since its introduction, January 1, 1900,¹ it has been a model which both railroad and industrial organizations have followed.

16. *Hope of advancement as a stimulus.*—So strong is the desire of most young Americans to advance, that many concerns make a practice of holding out glowing possibilities to ambitious men, and at the same time they expect them to work at first for very small wages. Where the firm is sincere in its promises no employe will complain, but it is nothing more than obtaining services under false pretenses to

¹ See U. S. Dept. of Labor Bulletin, 1901, p. 1090.

get the best out of an ambitious man and then let him go when he can be deceived no longer.

One has only to run thru the list of "situations wanted" in a morning paper to see how prevalent is the willingness of employes to sacrifice money returns if only steady advancement is assured. Out of a total of 1,129 situations wanted, advertised in one paper, over 12 per cent of the applicants emphasized the "future." In another paper, 14 per cent of the "commercial help wanted" ads referred to "chances of advancement."

"Don't go outside to fill a vacancy if you can help it," is a policy now generally accepted as the best. Strict seniority, however, is apt to drive out the men of force and initiative. Accordingly, some firms disregard the strict rule of seniority by confining its application chiefly to the minor positions, the higher offices being quite free from its influence.

REVIEW

What conditions in America and to a lesser degree in Europe are forcing managers to a scientific study of the cost of manpower?

Employers of labor are considering the subject of "misfits" on the job with greater interest than they did a few years ago. Why is this?

What argument can you give for a division of the labor units into resting-time units and working-time units?

In your estimation, what would be the economic and social effects if business men knew what a fair day's work consisted of, and acted accordingly?

Under ordinary conditions what drawback exists when a manager raises the wages of his employes far above the customary rates?

How can a manager keep fully informed of the character of the workingmen in the various departments, and still hold his foremen responsible for the selection and control of them?

What relation is there between an employe-pension system and stability of employment?

Why do employers, in taking on new men, often say, "The wages will be small, but the chances for promotion are good"?

CHAPTER XXI

SOURCES OF ADMINISTRATIVE INFORMATION STATISTICS AND INSPECTION

1. *Use of statistics.*—Only when statistics can be employed progressively are they effective. It is not so important that past conclusions be confirmed by statistics as it is that deductions for the future be correctly drawn. Only when they take on the latter character may they be said to be vitalized.

Among the monthly reports of the Harriman lines is one of particular interest because it looks forward instead of backward. It asks not for an explanation of the unsatisfactory conditions shown by the figures, but for a statement of what action has been taken to correct them.

.....R. R.Division.
.....19....

General Superintendent:

Dear Sir.—I transmit herewith explanations of fluctuations in operating expenses for 19...., compared with the same period of previous years, having personally reviewed the month's exhibit.

The fluctuations are regarded by me as unsatisfactory, and I have taken action to improve results in future periods.

2. *Graphs and statistics.*—The graphic method of presenting statistics, tho inferior to the numerical in accuracy, has the advantage of enabling the eye to

take in at once a series of facts. This advantage is not of first importance when we are considering only one set of facts. Accuracy is then more essential than ease and rapidity of representation. But ease and rapidity are essential when we want to compare many sets of facts, because if the mind is hampered in getting the general effect of one set, it loses count of the others. The function of the graphic method is the comparison of different sets of statistics. A former president of the New York Central told the New England Railway Club how a simple use of graphic charts saved the road \$2,000,000.

Thirty years ago we built four grain elevators in Buffalo. In 1909, it became necessary to rebuild them, and two million dollars were appropriated. However, I had an analysis made of the grain business, and plotted a chart of the curves of production and consumption. Those lines cross at 1913, meaning the probable end of exporting grain, and we decided to spend only \$80,000 and merely repair the existing elevators.

3. *Indicating relation of one set of facts to another.*—Another function of graphic charts is the indication of the true relation of one set of facts to another. For instance, it is known that cost varies with output. In starting a new business or shaping new plans it might be desirable to know just what this variation was likely to be in order to estimate how much business would be necessary to overcome the initial expenses, and what profit should be realized from a given volume of business. A chart will show

far more clearly than statistical tables the variations of two factors in relation to each other.

4. *Comparisons of time periods.*—Still a third class of information which can be advantageously studied with the aid of curves is that which involves comparison from month to month of such items as costs, sales, output, etc. Almost any kind of information can be plotted with time as the horizontal coordinate, and the desired information as the vertical. Curves representing succession units of time are most convenient when they read from left to right. The advantage is that the curve can be kept up to date, and that comparisons with previous and standard conditions are grasped more easily and present the results over a long period of time. For instance, the average market price of a product for every business day in the year can be shown in much less space than is possible in any other way. In the matter of output, sales, costs, etc., it is customary to carry in addition to the quantity for the period, the cumulative total for the year. The height of this curve always shows the total business to date, and its slope shows whether the tendency is for the volume to increase, remain stationary or fall off. Conditions making for or against improvement may thus be understood sooner than they would be if tabulations of figures were used. Note, for instance, how quickly you catch in Figure 13 (page 288) the relation between orders and shipment. In it are also shown a cumulative total and the plotting of two or more curves to scale on the same chart.

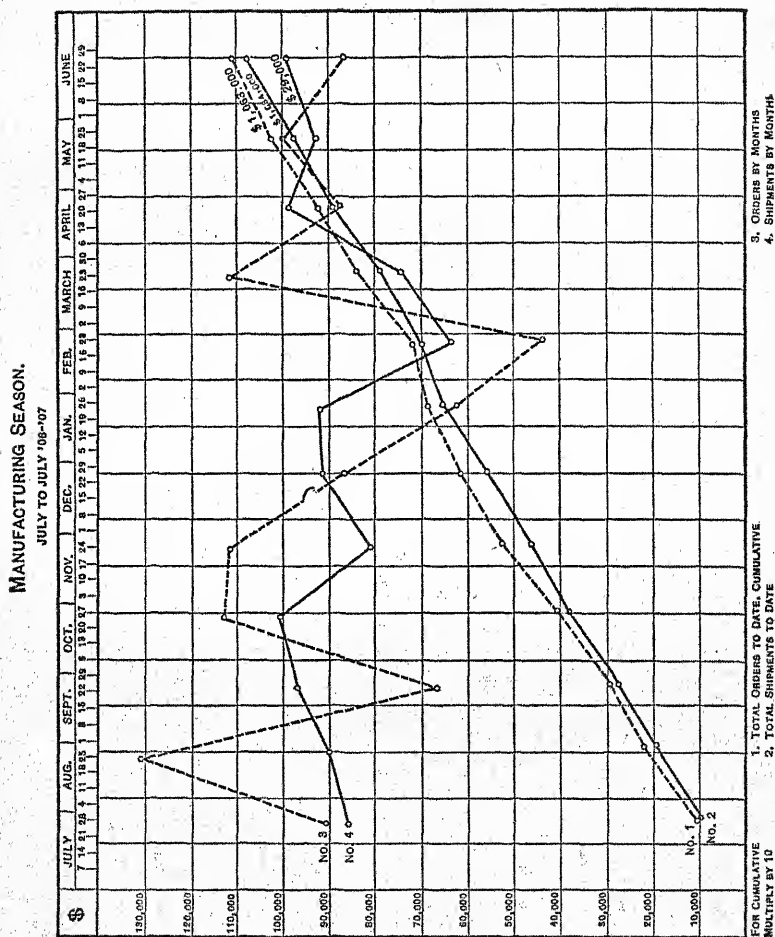


FIGURE 13.—GRAPHIC REPRESENTATION OF RELATIONS BETWEEN ORDERS AND SHIPMENTS IN A MANUFACTURING CONCERN.¹

¹ Reproduced by permission from Woods' "Reports on Industrial Organization, Systematization and Recounting."

5. *Reports.*—Reports from subordinate officers to the management are the most common means of collecting information. The trouble with them in most cases is that they are too long delayed to be of real service. This need not be the case; reports can be kept up to date. All that is needed is a time schedule. The payroll, to give a familiar illustration, is always complete at the end of the week, because the men must be paid at noon, but the cost department, using the same data and doing the same work, merely making the debit instead of the credit entry, is allowed to fall a month or more behind in its work. In fact, the only difficulty in keeping a department up to the minute lies in catching up at the beginning. The department that is regularly three months behind is handling a full day every day; otherwise it would continue to fall behind instead of remaining regularly three months in arrears. After it has once caught up, the same effort will enable it to stay caught up. In fact, work that is up to date is more easily handled; since errors or discrepancies are readily detected while the matter is still in mind, they are difficult to get at after the incident has been forgotten. Improved accounting methods, which utilize perpetual inventories and controlling accounts, make it possible to keep in daily touch with the financial condition of the business, instead of waiting for a monthly or yearly stock-taking. Robert Owen, at the beginning of the last century, was accustomed when away to receive daily reports from the mills at New Lanark; present-day execu-

tives who are not in daily touch with conditions are more than one hundred years behind the times.

6. *Determining facts by inspection.*—Another method of determining the facts of a business is inspection. One may be well assured that in these days of keen competition and close scrutiny of expense of all kinds, the outlay for inspection must be considered a good investment, or it would not be tolerated by so many important companies.

The inspection methods of the Westinghouse Electric and Manufacturing Company¹ are typical of large engineering concerns. The inspection department, which is under the supervision of the manager of works, consists of several hundred men and this force is divided into two sections; one for the inspection of apparatus building in its own works, the other for the inspection of all materials coming from outside manufacturers—including the various raw and partly finished materials—and of apparatus of its own manufacture returned for any reason, such as for repair or exchange, or sent back from loans or exhibits, etc. Materials coming from outside manufacturers are generally inspected upon arrival at the works, tho certain kinds of a special nature, such as bar pulleys, etc., are often given a preliminary inspection or test at the place of manufacture.

In addition, representatives of the company are sometimes delegated to inspect the works of manufac-

¹ "The Work of Shop Inspection," C. B. Anel, *American Machinist*, May 25, 1911, p. 977.

turers with whom there seems a likelihood of doing business, to see if their facilities are such as to enable them to furnish materials of the degree of excellence required.

The material specifications prepared by the Material Committee are made use of by the inspection department in seeing that the materials supplied are actually what was ordered.

A very complete chemical and testing laboratory is maintained by the company, and full advantage is taken of it not only in the preliminary testing of raw materials but also in the examination of partly finished material or apparatus at various stages during the process of manufacture.

Careful records are kept of materials rejected or found defective in any respect, and steps are taken to see that they are promptly disposed of, to prevent any possibility of their becoming mixed with accepted materials.

7. *Inspection of work in process.*—In the inspections of the company's apparatus endeavor is constantly made in each department to have the work inspected during the actual making as well as upon completion.

As there are 85,000 different items listed in the stock room it would be impossible to inspect every individual piece. When automatic and semi-automatic machinery is used, after it is properly set and working it is necessary to inspect only a small percentage of the output with a view to preventing the dies from wear-

ing out or getting out of alignment. On the other hand, apparatus which is made by hand with special limit gauges, templets, etc., requires frequent detailed inspection of all its parts, and this the company aims to give.

Next to inspecting the work while it is still in the workman's hands, the best method is to have the material after each operation delivered, with an identification tag, to an inspector and approved before going to the next operator.

Some concerns hold each man responsible for defects in the piece on which he works, thus causing him to examine carefully all the work he receives, for errors of the preceding workers.

8. *Questions as guides.*—It is of great assistance to the inspectors, especially the new men who are being trained, to be supplied with some list of questions such as the following, which call their attention to special points to be noted. The questions are so framed that they may be answered by yes or no; thus the amount of writing required is minimized.

COMPLETE MACHINE INSPECTION TAG OF THE

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

Has frame been cleaned and painted inside?.....
Are field coils tight, and is bore of field correct?.....
Are holes evenly spaced?.....
Do interpole bolts extend beyond shot face?.....
Are connections between field coils properly cleaned and insulated?

Has flame-proof braid been removed from brush-holder ends
 and replaced by tape?.....
 Are housings entirely free from dust and core sand?.....

 Do bearings and housings fit, and is alignment correct?....

 Are oil grooves chipped in cells?.....
 Is drain hole provided for waste oil?.....
 Are brush-holders properly spaced and brush tension cor-
 rect?
 Are brushes parallel with commutator segments?.....
 Are oil covers properly fitted?.....
 Is pinion tight on shaft and key properly fitted?.....
 Does gear-case clear gear?
 Did commutator develop high-bar on test?.....
 Serial
 Order
 Inspected by.....

9. *Qualifications of inspectors.*—Inspectors should be chosen from among experienced workmen and, if possible, from the department where they will serve as inspectors. They should be men imbued with a sense of the responsibility of the position and with good judgment not only in passing on materials but in dealing with men.

Judgment is essential in inspection because while some variations from drawings in no way affect the utility of the machine, others may cause serious results. All defects and variations are given careful consideration in order that it may be determined whether the piece should be scrapped outright, whether the imperfection may still be rectified or, if

the fault be an unimportant one, whether the machine or apparatus may be passed as it stands. Of course, a full knowledge of the situation is required before an intelligent decision can be arrived at. If the inspector is undecided he refers the matter at once to the department head, stopping all work thereon, pending a decision.

10. *Information from the outside.*—The efficiency of inspection depends in very large degree upon the aid received from the engineering, correspondence, testing and other departments. Every letter of complaint is accepted at its face value and conditions are thoroly investigated: first, with a view to ascertaining the cause of the trouble; second, with a view to preventing a recurrence of it. It will be found decidedly efficacious when complaints are received involving defective workmanship, now and then to send the foreman or inspector of the department at fault to see for himself the cause of the trouble. In this way, his viewpoint will be broadened and he will appreciate more fully than he would otherwise the necessity of good work.

No matter how adequate the organizations may be, there will be certain points, particularly with new apparatus, or new applications of standard apparatus, that can be gleaned only from actual experience. Hence, the efficiency of the works must depend to a large extent upon the suggestions of their erecting gangs and customers.

11. *Various kinds of inspection.*—Inspection as a

means of gaining information is not confined to mechanical lines. Traveling auditors perform similar duties in a different field. Spasmodic inspection, however, unless backed by proper reports, is liable to result in erroneous impressions. Conditions are likely to be unusual and the men nervous. In fact, companies often waste considerable money in this kind of investigation. When it is rumored that an inspection is to take place, men are taken off their regular work and set to cleaning up, since so many officials under such circumstances confuse appearance with efficiency. This loss of time may be prevented in part by having the inspection take place unannounced; but better by the percentage system, which provides that a certain percentage of the work be examined or an established number of inspections be made, the particular lot or time of inspection, of course, being unknown. If the work inspected proves satisfactory the entire amount is passed. If any defects are found the entire lot is carefully examined for further errors.

REVIEW

Why are business men inclined to dislike statistics?

What important information can be conveyed to an executive thru the medium of the graph?

Inspection plays an important part in every business. Explain the basic reason for this fact.

How can inspection be improved thru the cooperation of the laborers?

If the selection of an inspector were among your duties, what qualifications would you keep in mind whereby you could test the applicants?

CHAPTER XXII

SAVINGS IN TIME: RESEARCH AND RECORDS

1. *Inspection and research.*—Closely allied with inspection, so closely allied, in fact, that one set of apparatus often serves the two functions, is research. The two functions are, however, distinct. Inspection is for the purpose of insuring that the work of material shall come up to certain prescribed standards. Research is for the purpose of determining these standards and for discovering possible improvements in the product or the manufacturing processes. Research is much like advertising; its value is cumulative. The first results are likely to be disappointing, and if the work is discontinued they are absolutely worthless. When the general plan of recording all results is followed, however, apparently useless results often prove of great assistance in the solution of future problems. The General Electric Company spends annually two and a half million dollars in making and developing inventions. In addition to its experts it employs a corps of twelve patent-attorneys and twenty-eight assistants. The Westinghouse Electric Company maintains a department almost as large and expensive. The Pennsylvania Railroad Testing Laboratories at the company's Altoona shops were established in 1875, and employ over 200 men. The American Telephone

and Telegraph Company, the Hoe Printing Press Company, and scores of smaller concerns carry a force of salaried men whose duty it is to make inventions and to develop their possibilities.

2. *A large research laboratory.*—Probably one of the largest and best equipped commercial laboratories is that of the J. I. Case Threshing Machine Company, which makes every kind of machine used in threshing grain. It has its own facilities, but to offset the heavy expense of maintaining the laboratory, it does commercial work for other firms.

The laboratory occupies four rooms in the company's office building. One is the laboratory office, in which the reports are made up and the results of the various analyses and tests are recorded for use, reference and distribution. The office contains a library of several hundred volumes on subjects relating to chemistry, physics, electricity, heat, power, manufacturing, etc. The fine microscopes, barometers, hygrometers, anemometers, machines for electrolysis, grease-testing machines, glue testers, etc., are also kept here. Among them are a number of very delicate scales, one sensitive to the 1200th part of a milligram.

Samples of all kinds of minerals, paints, oils, drugs, paper, cloth, leather, rubber, cordage, fuels, clays, brick, etc., are kept here for reference, inspection and comparison. The collection of samples forms a basis of a valuable education not only for the chemists but for the shop foremen.



The system of record-keeping is careful and accurate, and data for years back are a very valuable feature. One set of books is used for research work, one for recording chemical analyses, one for physical tests, and one exclusively for foundry work.

3. *Commercial results.*—The head of the laboratory not only is an expert chemist, but he has had many years of practical experience in the iron and steel, rubber, leather, oil, paint and other industries. Being thoroly practical, he is able to judge of the value of any particular chemical analysis or physical test. This practical knowledge, of course, is essential in a laboratory of this kind, for while any chemist may be able to make an analysis, yet in applying chemistry to practical work he may be entirely at a loss, and thru lack of personal experience in the manufacturing or commercial side of the problem he may often do more harm than good. Each of the assistant chemists handles a special line of work, so that the laboratory runs in a systematic manner. A very important feature of its work is the making of specifications for the raw materials which the company uses. This involves a great amount of testing and research work.

Another feature is the investigation of the causes of failures and breakages and the solution of the difficulties. This is also an important part of the work of the Pennsylvania Railroad and of the Westinghouse testing laboratories, and their procedure is almost identical with that of the J. I. Case Company. Thus, if a threshing machine shaft, bearing or belt

proves defective or breaks for an unknown cause it is shipped to the laboratory and carefully tested and examined. If the fault is due to poor workmanship or defective materials, the chemist reports the fact and the part is replaced free of charge. If the examination fails to show the cause, the foreman or chemist is dispatched to the locality where the trouble occurred to make a thoro investigation. If an inordinate strain has been applied or unusual conditions introduced, the investigator is in a position to suggest the necessary changes. Altho this method is expensive, the company feels fully repaid in that such a plan insures the confidence of its customers and tends to improve future output.

4. *Time-study*.—One phase of research work which has awakened a great deal of interest, and to which reference has been made in preceding sections, is time-study; that is, the scientific determination of the amount of time it should take a man to do a given piece of work. Frederick W. Taylor, who has been closely associated with time-study methods, describes this work as follows: ¹

It has been the writer's experience that the difficulties of scientific time-study are underestimated at first, and greatly overestimated after actually trying the work for two or three months. The average manager who decides to undertake the study of "unit times" in his work, fails at first to realize that he is starting a new art or trade. He understands, for instance, the difficulties which he would meet in establishing a

¹ Transactions, American Society of Mechanical Engineers, Vol. XXIV, p. 1423.

drafting room, and would look for but small results at first if we were to give a bright man the task of making drawings who had never worked in a drafting room, and who was not even familiar with drafting implements and methods, but he entirely underestimates the difficulties of this new trade.

The art of studying "unit times" is quite as important and as difficult as that of the draftsman. It should be undertaken seriously and looked upon as a profession. It has its own peculiar implements and methods, without the use and understanding of which progress will necessarily be slow, and in the absence of which there will be more failures than successes scored at first.

In the course of this work Mr. Thompson has developed what are in many respects the best implements in use, and with his permission some of them will be described. The blank form or note-sheet used by Mr. Thompson, shown in Fig. 14, contains essentially:

1. Space for the description of the work and notes in regard to it.

2. A place for recording the total time of complete operations—that is, the gross time including all necessary delays for doing a whole job or large portion of it.

3. Lines for setting down the "detail operations" or "units" into which any piece of work may be divided, followed by columns for entering the averages obtained from the observations.

4. Squares for recording the readings of the stop-watch when observing the times of these elements. (If the squares are filled, additional records can be entered on the back.)

The size of the sheets, which should be of best quality ledger paper, is $8\frac{3}{4}$ inches wide by 7 inches long, and by folding in the center they can be conveniently carried in the pocket or placed in a case containing one or more stop-watches.

In the illustration the operation consists of a series of elements. In such a case, the letters designating each elementary unit are entered under the columns "Op," the stop-watch

is thrown to zero, and started as the man commences to work. As each new division of the operation (that is, as each elementary unit or "unit time") is begun, the time is recorded. During any special delay the watch may be stopped, and started again from the same point, altho as a rule Mr. Thompson advocates allowing the watch to run continuously, and enters the time of such stop, designating it for convenience by the letter "Y."

5. *Time-study reduced to formula.*—The elementary operations are usually fewer in number than the complex processes of which they form a part. This greatly simplifies the problem. When the standard elementary times have been determined and tabulated, the standard time for any new work can be determined without making a special study, by combining the proper known elementary times. In fact, formulas can be deduced, exactly like other engineering formulas, in which the varying quantities, such as the distance traveled or the weight moved, may be substituted, and which, when solved, give the standard time that the job should take.

Any variation of this standard time from the actual time taken in doing the job represents avoidable loss. To eliminate the waste it is often necessary to change the workman's methods of doing the work or to redesign the machinery so as to facilitate operation.

Where the operations run into the thousands the best results are obtained by grouping them into classes according to the similarity of design, shape and mechanical operation of the machines, and then making an accurate study of each group. While it is prob-

6. *Written aids, books, etc.*—Books on topics connected with management are of value as a basis for obtaining an education in fundamental principles or for convenient reference. The English philosopher, Dr. Samuel Johnson, has said that one-half of a man's education consists of knowing where to get information. To keep abreast of the progress in one's own field it is also necessary to supplement the information in books with periodical literature.

7. *Periodicals.*—Among the most valuable sources of printed information today are the trade papers and the proceedings of the various technical societies. These supplement each other. The latter are somewhat more general, in that the proceedings enumerate the theories, the discoveries, or the results of experiments conducted by the members.

In the same class with the proceedings of the technical societies must be placed the publications offered by the general and state governments. While the various departments of agriculture are doing the best work, much valuable information concerning business is contained in the publications issued by the bureaus of commerce and labor. A small charge is made for some of them, but the majority are issued free. Illinois has established an Engineering Experiment Station in connection with its school of engineering, and has investigated such important topics as fuels, building material and railroad equipment; it has published its findings for the benefit of Illinois manufacturers.

8. *Government publications.*—The Superintendent of Documents, Washington, D. C., publishes two monthly catalogs listing all publications of the Federal government.

In addition to making use of the library facilities of the community, many companies find it advisable to maintain special libraries of their own, either separately or in connection with their testing laboratories. These libraries also collect special material, which cannot be secured thru the regular channels and which includes the literature of their competitors, forms, formulas and the like.

9. *Study of competitive methods.*—Another source of information is data obtained from competitors. When the Pennsylvania Railroad considered the question of pensions, a special committee on Superannuation and the Pension Fund was appointed by the advisory committee of the relief department. The committee examined and reported upon the various systems of pensioning in operation on more than seventy of the leading railroads of Europe, America, Asia, Africa and Australia. When the Weston Electrical Instrument Company resolved to build its new plant at Newark, N. J., it sent three practising engineers on a year's tour of American plants, two of the engineers to study mechanical features and one to discover what arrangements other companies were making for their employes' comfort.

Mr. C. B. Anel, Assistant Manager of Works, Westinghouse Electric and Manufacturing Company,

in a recent speech before the National Machine Tool Builders' Association, said:

Recognizing that methods of manufacture which had in the past been satisfactory for their needs were proving inadequate to handle the increasing volume of business, for the reasons already stated, the Westinghouse Electric and Manufacturing Company spent considerable time in investigating the methods of other large companies in similar lines of business, with the result that it was believed advisable to modify the original scheme in favor of the so-called "factory system."

In a recent article in the *American Machinist* appeared this significant paragraph:

The firm stands ready to furnish information concerning its experience in this line which may be useful for others who are thinking of establishing laboratories for themselves.

10. *American readiness to supply information.*—The liberality with which American companies are willing to share their experiences has often excited the surprise of European visitors, since abroad the methods of doing business are zealously guarded from all outsiders. In fact, so general is the "get-together" idea in American industry that a firm's willingness to give information is a fair indication of the value of the information that it has to give. Small concerns are often opposed to giving away "trade secrets," whereas the large corporations are glad to show visitors thru their works and to furnish any information within reason. Conversely, many of them make a practice of sending their foremen and department heads to visit other factories.

One method which has proved effective in writing

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to a competitor for information is to state, "This is the way we are now handling the matter; if you have a better method we should like to hear of it." Another method when an extended investigation is planned, is to state the fact and offer to give other companies copies of the results, provided they will cooperate by describing their methods. A recent inquiry of this kind addressed to fifty firms concerning their method of applying the "suggestion" system brought thirty-five replies.

9. *Consulting experts.*—Specialists exist in almost every line of business. There are consulting engineers, certified public accountants, testing chemists and patent-lawyers. In the steel business there are agencies which will inspect the work in the mills, while there are advertising and sales experts and information bureaus without number. This specialty work is now being systematized by many agencies, so that the business man may secure information more readily than he ever could before.

REVIEW

How is the manager of a factory aided by its research department?

Why should the manager of a testing or research bureau have a strong appreciation of commercial values?

The last few years have seen much attention given to time-studies. How could you show that investigation along these lines belongs to the research department? Could you show also what the relation of time-study is to inspection?

Discuss the value of books, trade papers, etc., as aids in the saving of the manager's time and control of a factory or office.

Why should a company be willing to aid its competitors in every way possible in the matter of laboratory or research work?

CHAPTER XXIII

SAVINGS IN TIME—ROUTING

1. *Time-saving by "routing."*—London and Paris first learned of the death of Pope Leo XIII from New York, altho New York is 3,000 miles farther from Rome than either of those two cities. This was because the Associated Press had routed the news.

As a courtesy to the Church, in order that Cardinal Rampolla might have time to notify the papal delegates, the Italian Minister of Telegraphs refused to allow any news of the Pope's death to pass until two hours had elapsed. When the Pope died, an attaché immediately telephoned the Associated Press representative two miles away, who in turn cabled to the New York manager personally, as had been previously agreed, "The number of the missing bond is 404 Montefiore." To avoid any suspicion, the number which gave the time of the Pope's death was to be written backward, as 352 for 253, or 53 minutes past 2. It happened that this made no difference. When the telegram arrived in the New York office its contents were shouted to the sending room and each operator flashed the news over his circuit. Altho the message was relayed at Havre and again at the French Cable Company's office in New York, the New York

papers knew of the Pope's death nine minutes after it had happened, and the San Francisco papers, eleven minutes. The foreign newspaper agents in New York sent the news to their respective cities long before these cities had heard directly from Rome.

In the Associated Press methods we find an admirable illustration of efficiency gained thru careful planning and routing.

The routing of news seems easy, perhaps, because of the nature of the substance routed. The routing of materials over a line of railway is the next best illustration. Since the elements here involved pertain to industrial routing as well as to transportation it is well to study them carefully.

2. *Essentials in routing.*—Railroad dispatching has three factors:

1. A route carefully laid out.
2. A prearranged time schedule of all trains, based on the experience of the road.
3. A train dispatcher, whose duty it is to keep the trains moving according to schedule and, if this is not possible, at least to move them to the best possible advantage.

The proper routing of work thru shop or office is characterized by the same three features:

1. A prearranged route.
2. A predetermined time schedule.
3. A dispatcher.

A near approach to the railroad schedule in the com-

mercial world is the delivery-routing system of a big retail store.

3. *Securing a good plant layout.*—The physical routing of the work in a business is determined mainly by the plant layout, in exactly the same way that the railway train route is determined by the track, and the same care should be given to laying out the plant that is given to a railroad survey.

Mechanical helps are of great assistance in arriving at the best solution of the factory problem just as the chart is of great assistance to the railroad man in connection with his time-table. It is well to cut templates to the scale of the machines, including their necessary clearances and working spaces, and then to shift these until the best departmental arrangement is found. A symmetrical arrangement means always the most economical use of space. Then cut templates of each department and fit them into one another in the same way as in determining the complete layout. It is much easier to shift paper than to carry the idea in one's head or to work up a sketch with pencil and rubber. Another method is to prepare several distinct layouts on tracing paper and then, by superimposing them, make a final sketch including the best features of each. This method is followed by most architects. When the ultimate solution is determined by the site, as in a city lot or in rented quarters, this method works well; but where perfect freedom is possible it is not likely to give so good a layout as the

first method, since it works from the wrong end. The ultimate solution of the layout problem of any business will be determined by the interplay of the same four factors, work to be done, straight-line movement, gravity and cost. But while this is true in general, differences in application of the principles arise as soon as they are applied to industrial conditions.

4. *Straight line between terminals.*—All manufacturing touches the outside world at two points—the receiving and shipping departments. These are the terminals of the road; and the simplest and best layout, other things being equal, is a straight line between these two points. Where the plant has only one connection, as one street or one railroad siding, the routes must generally constitute a circle, so that the start and the finish will be at the same point, or a U or series of U's, both ends of which touch the outside world. When, however, other exits are possible, receiving and shipping need not unduly influence the routing, but may be located so as to facilitate manufacture. As soon, however, as these elementary conditions of the location of the "industrial terminals" are passed, there appear more important complications which affect the routing.

5. *Various types of manufacture.*—All manufacturing is analytic, continuous, assembling, or more often a combination of all three processes. Thus the work of the United States Steel plant at Gary is analytic, in that it breaks the coal up into coke, gas and tar, each of which must then be handled separately.

The next operation is to unite the coke, ore and limestone, which must be received separately and united in the blast furnaces. It is then analytic again, in that it separates the iron from the slag, which is subsequently manufactured into cement; and finally it is continuous, in that the iron continues without further additions until it emerges as bars.

6. *Analytic manufacture.*—The analytic type of manufacture is one in which the main material is gradually dissected to form many products, one of which is, however, usually of predominating importance. The best illustration is the meat industry, where the carcass is broken up into beef, hides, bones, etc., each of which is treated separately after it leaves the main stream. The important point in such industries is to provide means of taking away the parts that are removed, so they will not collect and block the main stream of work.

7. *Continuous manufacture.*—In the continuous manufactures the mass remains the same thruout the process, being merely acted upon and changed in form. This is by far the simplest kind and might be compared to a canal where the entire bulk of the water enters at one end and leaves at the other. In weaving, the thread enters at one end of the loom, and after the application of labor alone, emerges as cloth at the other. In milling, the wheat enters at one end and the flour emerges at the other.

8. *Assembling manufacture.*—By means of the assembling process many different materials are re-

ceived, worked upon and gradually brought together to make the finished whole. Building is the best illustration because it is exclusively an assembling operation. It assembles the bricks, cement, plumbing and other manufactured products into a house. The important thing in assembling is to see that the necessary parts come together at the right time and place, for all subsequent movement must wait until all the parts arrive.

9. *Passageways must be provided.*—Whatever the type of manufacture, sufficient room must be allowed to provide convenient access to all parts of a machine, and to allow for the removal of any machine whenever necessary. Sufficient area must exist for the storing of as large a supply of working material and finished material as may be necessary, without interfering with the passageways. Storage facilities must be provided at each point where the flow of work is likely to be interrupted and wherever two streams unite. In order to minimize this area, the most economical method of stocking should be determined and the space should be allotted accordingly.

10. *Transportation.*—Adequate transportation facilities must be provided.

The open areas must be wide enough to permit the passage of two trucks in the aisles and for the sidetracking of trucks around machines. A truck system involving the retention of the material in the trucks, with as little unloading as possible, is an important feature and one deserving attention in an establishment. It involves the building of a considerable number of trucks, and departmental supervision, but is likely

to result in economy. In some instances trucks are desirable, built so as to pick up and deliver a sheet-steel keg for holding work in progress. An ample supply of metal "tote boxes" for holding small parts will facilitate stock-moving and lessen losses of small parts.¹

Derricks, traveling cranes and industrial railroads are a great convenience in the handling of heavy materials and are often a necessity. Belt, link, gravity and pipe lines are serviceable where the material is uniform or will flow. Where the plant consists of several buildings it is customary to connect them by a system of tunnels radiating from the power house. These tunnels have cement floors, and brick and cement walls, waterproofed with asphalt. They are large enough to accommodate the trucks used and to allow a man to stand upright. They usually carry the electric and water pipes but no drainage.

All service departments, such as stock rooms, drafting rooms, tool rooms, and wash and locker rooms, should be centrally located so as to be equally accessible from all the departments which they serve.

Certain departments are by their nature mutually exclusive.

Obviously it would be inconsistent to have a saw mill in the same room, or enclosure, with departments for shellacking and final finishing of wood surfaces, as good work of this character cannot be performed where the surrounding air is carrying even a small amount of dirt or grit.²

Some work, on the other hand, is better done in conjunction with other work of the same kind. Stiff hats

¹ Hugo Diemer, "Factory Administration," p. 15.

² Day, "Industrial Plants," p. 51.

are dried four distinct times during their manufacture and it would be uneconomical to equip four separate drying rooms in order to prevent retracing one's steps.

11. *Growth must be allowed for.*—Railroads are now accustomed to look into the future and build their bridge piers and terminals to accommodate the expected increase of traffic. The first requirement for systematic expansion is land. One of the main reasons why big businesses are moving from the cities to the suburbs is that they must provide for future growth. It is essential, however, that a growing concern

shall not burden itself at the beginning to provide for future prospects. One of the surest plans a concern can follow to prevent it from ever requiring expansion room is to incur too heavy an expense in securing a location that will permit future growth.¹

12. *Expansion not to interfere with flow of work.*—The buildings should be designed to permit expansion without disturbing the flow of the work. The simplest style is the one-story building taking its light from the roof. This can expand indefinitely in all four directions. In all multiple-story buildings, sidelighting must be provided for and so growth is made possible only by extending the ends or by erecting separate additional buildings, much as a filing cabinet is built up by adding units. This is possible only in schools or textile mills where the work is uniform and can be shifted from building to building without

¹ Duncan, "Principles of Industrial Management," p. 34.

loss. Where the movement is in a straight line from the receiving room to the shipping room the lateral growth will add capacity without changing the method. An example of this system is the plan of the United States Steel Corporation's plant at Gary.

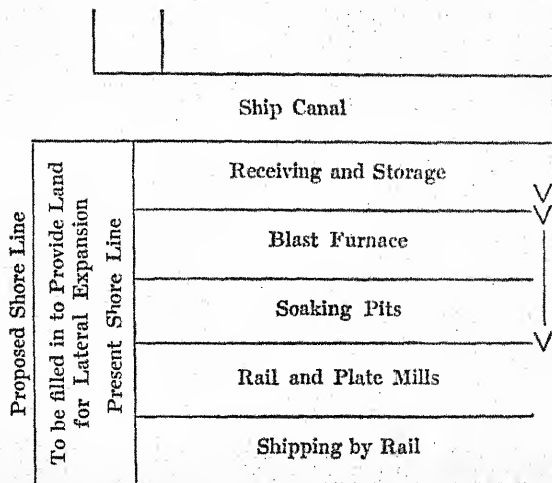


FIGURE 15.—GENERAL LAYOUT OF U. S. STEEL PLANT AT GARY.

The same idea in multiple-story buildings is shown in the plant of the Wagner Electric Manufacturing Company of St. Louis and the Allis-Chalmers Com-

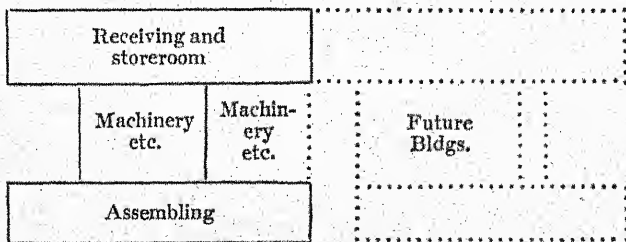


FIGURE 16.—LAYOUT OF A PLANT WITH MULTIPLE-STORY BUILDINGS.

pany. The idea underlying all such building is to have the work which may need the most room in the future, touch the growing end.

	Dept. 3	Dept. 2	
	Dept. 4	Dept. 1	

FIGURE 17.—CORRECT LAYOUT OF DEPARTMENTS.

By arranging the departments as in Figure 18, the management would exclude growth in department 2 or 3.

Dept. 1	Dept. 2	Dept. 3	Dept. 4
---------	---------	---------	---------

FIGURE 18.—INCORRECT LAYOUT OF DEPARTMENTS.

13. *Taking advantage of gravity.*—The force of gravity being universal, it influences manufacturing no less than railroading. Every time a load is brought down stairs and taken back again, energy is wasted. There are two ways to avoid this waste. The materials may be taken directly to the top floor and allowed to work back systematically to the first thru

the manufacturing processes, or they may be started on the ground floor and systematically worked up to the top. The finished product may then be brought down. The first way is usually the better as the energy stored in moving the materials to the top may be economically used to transport them thru the manufacturing processes back to the shipping room on the ground floor.

Gravity should be recognized in small individual operations as well as in a great mass. In the best organized shops machine tenders are no longer allowed to drop their product on the floor. They take it from a movable table at machine height and pass it thru the machine to another movable table so that when the work is finished the materials can be rolled to the next operator, with a saving of lifting and carrying. The trucks should have large wheels and large beam-ings. Lifting goods to a car or truck is unnecessary; the shipping room should be level with the floor of the car or truck.

14. *Time element in routing.*—Routing, however, involves not only materials and locations but time as well. Much routing in a high stage of development has gone unrecognized because business time schedules are not often recognized as such, being expressed as quantity of output. The time schedule of the Carnegie Steel Company, for instance, had a constantly increasing number of tons of steel per week, and every superintendent who fell below this mark was expected to explain. When analyzed, "5,000 tons

per week" simply means that 5,000 tons must be completed in 7×24 or 168 hours; in other words, that the production of a ton must never take more than $\frac{168}{5000}$, or .0336 hours.

15. *Two types of routing.*—From the time schedule standpoint there are only two classes of manufacture:

1. For stock; that is, the factory turns out the same thing continuously, throwing on the sales department the responsibility of finding a market for the product. This class includes textiles, typewriters, shoes, furniture, clothing, pianos and most of the ordinary goods which are consumed in quantity. Quantity time schedules are adequate for manufacture for stock.

2. For specific contract; that is, a single object is made to a customer's order. This class includes repair work on orders from the general shops, but its most important feature is the assemblage of large engineering products such as locomotives, large machinery, steamboats and buildings. Making connections is the important thing in manufacturing, as it is in railroading, for one late part will stall the entire work. A premature arrival is as bad as a delay. If the steel for a modern skyscraper arrives before the foundations are complete, chaos ensues, for it is constantly in the way, retarding the work which must be done before the steel can be set. It may take a month or more to straighten out the confusion. It is therefore necessary to figure out the time necessary to manufacture each separate part, and to schedule the

starting date of each succeeding operation accordingly. These time schedules resemble ordinary railroad time-tables.

For example, in the Thompson-Starrett schedule for the construction of a New York office building, shown in Figure 19, on page 322, it will be noticed that the foundations start 11-1 (November 1), the day the excavation is finished, and not sooner, and that the steel erection starts 11-24 (November 24), the day the foundations are finished. The supplying of the granite, however, depends not only upon the completion of the steel construction, but upon the finishing of the foundation walls, and so the granite starts as soon as they are brought to grade, 12-8 (December 8). The limestone follows the granite 12-10 (December 10) and the brick succeeds the limestone 12-15 (December 15). The floor arches, however, depend again on the steel and follow right behind the rivets before the steel work is complete, and so thruout the building. The difference of a day or two between operations is to allow the time necessary to get the material on the job so as to be able to start at once.

REVIEW

Compare the essential features in the preparation of a train schedule with those in the establishment of a routing schedule in a factory or an office.

What mechanical aids may be used in working out the best routing schedule for a factory?

Classify the following manufactures according to the types mentioned in this chapter: the manufacture of shoes, of gas, of ships, of wall-paper, of flour, of steel, of automobiles, the building of a house.

A carriage manufacturer located a department for sawing in the same room with one for the shellacking of wood surfaces. What principle of organization did this plan violate?

An engineering concern bought a building in the heart of New York. The company grew rapidly. What difficulties were likely to arise in regard to location?

What manufacturing elements or classes should be kept in mind when the subject of time-schedule in routing the material is up for determination?

CHAPTER XXIV

SAVINGS IN TIME-DISPATCHING—AUXILIARY APPLIANCES

1. *When special dispatching is necessary.*—As in railroading, so in manufacturing the time schedule is the important thing, and the more spectacular method of special dispatching is resorted to only when unforeseen circumstances occur. Therefore, personal dispatching is of comparatively little importance in manufacturing for stock, especially where automatic machinery is used which sets the pace for the operator. It is, on the other hand, an important adjunct to manufacturing for specific orders, because the general and repair work, on account of its irregular nature, cannot be mapped out in advance and because the elaborate schedule of a building or other work may be entirely invalidated by the carelessness of one worker. Like the train dispatcher the industrial dispatcher must *know* his shop, its exact condition, its capacity, special characteristics of men and machines and the amount of work and materials he has on hand.

2. *How to plan the routing.*—But the dispatcher, or the order-of-work clerk, is not supposed to work out his schedules alone. The planning department provides him with all the necessary information as

TIME SCHEDULE
Class Office-Loft

THOMPSON-STARRETT COMPANY
BUILDING 123 WILLIAM STREET

No. 245 Date Dec. 1, 1909.

OFFICE SCHEDULE			WORK	JOB SCHEDULE			
ARCHITECT'S DRAWINGS TO BE LET CONTRACT	CONTRACT MUST BE LET ON OR BEFORE	DETAILS FOR SUB-CON		START		FINISH	
				MO.	DAY	MO.	DAY
			1 STEEL DRAWINGS				
			2 ARCHITECT'S DRAWINGS				
			3 WRECKING				
			4 EXCAVATION	10-10		11-1	
			5 DRAINS AND WATER	10-10		10-20	
			6 CAISSONS-FILES				
			7 FOUNDATIONS-CONCRETE	11-1		11-25	
			8 WALLS TO GRADE	11-25		12-8	
			9 WATERPROOF	11-25		2-10	
			10 GRILLAGE-COLUMN BASES	11-10		11-20	
	9-10	9-20	11 STEEL ERECTION-STACK	11-24		1-1	
	10-10	10-15	12 ORNAMENTAL IRON-STAIRS-PLAIN	12-5		1-10	
			13 " " FINISH	2-3		3-10	
	10-10	10-20	14 ELEVATORS-GUIDES-TEMP.-CAR	12-20		1-25	
			15 " " CAR-SIGNAL-TEST	2-20		3-20	
	10-10	10-15	16 BOILERS	12-5		1-5	
	11-1	11-15	17 PUMP-TANKS	1-3		1-20	
	10-20	10-28	18 ARCHES	12-3		1-10	
	10-20	10-25	19 PLUMBING-GAS-ROUGH-TEST	12-3		1-20	
			20 " " FINISH-FIXTURES	2-10		3-15	
	10-20	10-25	21 HEAT-VENTILATION-ROUGH	12-3		1-20	
			22 " " REGULATION-FINISH	2-10		3-15	
	10-20	10-25	23 ELECTRIC-ROUGH-TEMP.-LIGHT	12-3		1-20	
	11-10	11-25	24 " " FIXTURES-MOTORS	2-10		3-15	
	10-25	11-2	25 COMMON BRICK WALLS	12-10		1-20	
	9-25	10-3	26 GRANITE	12-6		1-10	
	10-1	10-15	27 BLUESTONES	12-6		1-10	
	10-1	10-15	28 LIMESTONE-MARBLE	12-10		1-20	
	9-25	10-1	29 TERRA COTTA	12-20		1-20	
	10-5	10-25	30 FACE BRICK-ENAMELED	12-15		1-12	
	10-5	10-25	31 SPECIAL BRICK-MOLD-FIRE-HOLLOW	12-15		1-12	
	10-25	11-5	32 WOOD FRAMES-BASH	12-16		1-20	
	10-25	11-8	33 METAL FRAMES-BASH	12-16		1-20	
	10-25	11-8	34 FULLEYS-WEIGHTS-CHAINS	12-16		1-20	
	11-15	11-25	35 GLASS	1-7		1-20	
	11-10	11-20	36 ROOF COVER	1-8		1-25	
	11-10	11-20	37 SHEET METAL	1-8		1-25	
	11-10	11-20	38 BUCKS	12-25		1-25	
	11-15	11-25	39 STRIPS AND FILL	12-25		2-1	
	11-22	11-28	40 PARTITIONS AND FURRING	1-1		2-5	
	12-5	12-15	41 GROUNDS AND LATH	1-10		2-12	
	11-20	12-1	42 PLASTER-PLAIN	1-19		2-1	
			43 " " ORNAMENTAL	2-1		2-1	
	11-5	11-15	44 MARBLE WALLS-TILE	2-1		2-1	
			45 " " FLOORS-TILE, MOSAIC, TERRAZZO	2-10		3-10	
	11-5	11-15	46 HARDWARE-FINISH	1-28		2-13	
	11-15	11-25	47 TRIM-WOOD	2-10		3-20	
			48 " " CALOMINE	2-10		3-20	
	11-25	12-5	49 PAINT-DECORATION	2-20		3-20	
	12-1	12-15	50 FINISH FLOOR-WOOD-CEMENT	2-20		3-20	
			51 MAIL CHUTE	12-20		2-28	
			52 REVOLVING DOOR				
	1-10	1-15	53 PAVING-SIDEWALK-CURB	2-10		3-8	
			54 VAULT WORK				
			55 FILTER				
			56 SPRINKLER-PNEUMATIC-SWEEPING				
			57 ICE PLANT				
			58 LAUNDRY-KITCHEN				
			59 ENGINE-GENERATORS				
			60				
			61				
			62				
			63				
			64 FINISH BUILDING-SCHEDULE TIME			2-20	
			65 " " CONTRACT TIME			4-1	

FIGURE 19.

to what work is to be routed and how it is to be routed. The order-of-work clerk dispatches his jobs in accordance with these instructions. He must keep in mind a multitude of details regarding the machines, the men and all the jobs which have been routed for him, for it is his duty to keep the work moving. Accordingly, he is supplied with a dispatch or "route" board, the instrumental means by which the planning room controls the operating departments.

3. *What the route-board is.*—The route-board, which contains many groups of hooks—each group being composed of three sets, placed one above the other—shows the progress of all work and the movement of all material from point to point. When a job is assigned to a machine, the operation card is hung on the lowest one of a series of three hooks, each machine or working area in the shop being represented on the bulletin board by one of these sets of hooks. Thus the assignment of a job to a machine shows that all drawings, instruction cards, etc., are ready; that the materials are on hand and everything prepared for the machine to begin its work. It is then that the "operation order" which covers a given operation goes on hook No. 3, the lowest hook and the one which represents all "jobs ahead in the shop" for that machine. Next, when the materials have been moved to the machine, the operation order is put on hook No. 2, "jobs ahead *at* machine." Finally, when the job is actually begun the operation order is moved to the top hook, No. 1, "job *on* machine."

The order-of-work clerk, or for that matter any person interested, can follow the movement of a job thru the shop by watching the operation orders on these three hooks. If the job should be moved to another machine, then the operation order would be assigned to another group of three hooks, corresponding to the second machine.

4. *Planning-board signals all movements.*—Thus the planning-board signals the movements and indicates the sequence in which the jobs are done. This it does for the planning room; but the man in the shop must also be informed of these movements, for his activities depend on them. He must know whether he is to work at the same machine or at a different one after one job is completed. He cannot run to the planning room every time. Hence a miniature bulletin board is placed in the shop; and when an order in the planning room goes to hook No. 2, "jobs ahead at machine," a duplicate order goes upon the shop bulletin board notifying the worker what jobs have been planned ahead for him.

5. *Questions answered by route-board.*—By means of this route-board, a whole series of questions vital to the management can be answered immediately: (1) what job shall be done first; (2) if a machine breaks down what other machine can do the work; (3) if a man is absent what other man can do the job; (4) what is the cost of any operation on any machine for any hour, or what is the total cost of all operations going on at all machines in any hour.

6. *Status of work in progress.*—In all quantity manufacture—for example, for stock where the contract work is divisible into working units, such as certain railroad work where an embankment can be divided into cubic yards—a regular proportion must be completed in each unit of time if the entire contract is to be finished punctually. If the shop is unable to produce its quota at the start, it will surely be unable to make up the shortage in addition to the regular allotment at the end. It is, however, in the assembling industries that the progress of work must be most carefully watched. On the first indication that any one part is falling behind, it should be brought up to date either by employing men overtime or by increasing the force. Comparative figures are always more intelligible and therefore it is better, if possible, to combine the progress report and the time schedule, which show, at all times, the state of the job in relation to the schedule.

The American Locomotive Company's progress report is shown in Figure 20. The upper and lower heavy black lines indicate the time schedule and correspond with the start and finish dates on the Thompson-Starrett schedule. They are printed in red on the original form and are known as the danger lines. A black line is ruled under each department when all the work is finished to indicate this fact to the chaser. Figure 21 shows the same form as used in the machine shops. The starting and stopping lines have been omitted to avoid confusion. It will be noticed that

A. L. CO. PRODUCTION SHEET SCHEMATIC WORKS, MACHINE SHOP NO. 1										RAILS									
FRAMES										RAILS									
PART	REC'D	PLAID	SLOTTED	DRILLED	ASSEMB'D	REC'D	PLAID	SLOTTED	DRILLED	ASSEMB'D	REC'D	PLAID	SLOTTED	DRILLED	ASSEMB'D	REC'D	PLAID	SLOTTED	DRILLED
FOR ORDER, SWITCH, PAY, OR CASH DEL. NO.																			
OPERATION																			
TO BE BEGUN																			
TO BE FINISHED																			
NUMBER WANTED	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
NUMBER FINISHED	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
1908																			
1909																			
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
22	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
23	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
24	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
25	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
26	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
27	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
28	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
29	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
30	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
31	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
32	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
33	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
34	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
35	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
36	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
37	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
38	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
39	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
40	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
41	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
42	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
43	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
44	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
45	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
46	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
47	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
48	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
49	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
50	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Based as Actually kept

FIGURE 21.—RECORDS AS USUALLY KEPT.¹

¹ Reprinted by permission from H. L. Gantt's "A Graphical Daily Balance in Manufacture," in Transactions, American Society of Mechanical Engineers, Vol. XXIV, p. 1324.

the different operations follow one another in regular sequence. If any department holds up the work the fact is shown, for in such an event the figures do not follow those of the preceding department.

The information with which to keep such a report up to date may be obtained from the shop by means of the coupon form of order (Figure 22). This order, which follows, and which is usually wired fast to the piece, with a coupon for each department, resembles a railroad ticket. When the work in any one department is completed a coupon is detached and returned to the dispatcher, who enters the fact on his report. In this way it is possible to know by noon of any day the exact state of all work in progress up to quitting time of the day before, and so it is possible to push work which is falling behind. But in shops where the planning department is fully developed, the state of work is indicated on a "progress-of-work sheet" by the record clerk when the job is given out and when the ticket is returned by the worker. In outside work and work done by contractors it is customary to get the information by personal inspection. Thus one of the most important duties of Thompson-Starrett's "chasing department" calls for regular visits to the subcontractors and exact reports as to how their work stands with reference to the time schedule.

7. *How to route office work.*—The New York Clearing House illustrates the value of routing in office work. Each bank has a numbered desk and is represented by a delivery clerk and a settling clerk.

ORDER FOR CASTING Date _____ No. _____		FOUNDRY REPORT CARD No. _____ Detach and return to Office when castings for above are Put in Hand Date _____ Signed _____		PATTERN ROOM REPORT CARD No. _____ Detach and return to Storekeeper when patterns are Sent to Foundry Signed _____	
		Returned to Office when castings are finished		Returned to Office when pattern is sent to foundry	
RETURN THIS CARD TO FOREMAN WHEN ABOVE ARE CAST FINISHED NOTED UP		FIGURE 22.—COUPON FORM OF ORDER-TICKET.			

The settling clerk remains at the bank's desk and receives, records and receipts the checks returned by the other banks. The delivery clerk takes his place in front of his bank's desk, and on the manager's signal moves to the desk on his left, delivers the packages of checks, drafts, etc., drawn on that bank and deposited in his own bank, and after receiving a receipt for the package moves forward to the next desk, and so around the room. By this method the banks are enabled to exchange over \$300,000,000 in about ten minutes.

8. *Time schedule of the clearing house.*—The dispatcher is the manager of the clearing house. He directs the operations from his raised balcony at the end of the room. The following schedule indicates the promptness with which business is done:

- 9:59 Clerks must be in their places. Failure will be punished by fine.
- 10:00 Delivery starts.
- 10:45 Time up for making proof. Fines will be imposed for all mistakes remaining unlocated.
- 11:15 Fines will be doubled for all mistakes remaining unlocated.
- 12:00 Fines will be quadrupled for all mistakes remaining unlocated.
- 1:30 Time up for settling debit balances. A fine will be imposed on all debtor banks that have failed to settle their accounts with the clearing house.

1:30 Credit balances will be paid by the clearing house, but no credit balances will be paid until all the debit banks have settled.

The efficiency of this schedule is proved by the fact that altho the annual clearings have sometimes exceeded \$100,000,000,000, the greatest annual total of all the fines imposed was \$1,422 (1889) and it has fallen as low as \$280 a year (1904).

9. *How organization saves time.*—The purpose of organization is to enable each employe to work under the best possible conditions of team-play. The management should remove all obstacles to the workman's best performance and supply all the aids necessary. Delays not only waste the workman's time but shut down his machine. It is well to remember that an employe is not working for himself, and any assistance which an employer can give him enables him to do the concern's business more intelligently.

The workman needs certain aids in doing his work. These include power, machinery, tools, materials and the cooperation of his fellow-employes and the management. The need for supplying machines and power is so obvious that it hardly calls for mention. What needs emphasis is that the workman must be *continuously* supplied with power and equipment; in other words, that he must be protected from delays due to breakdowns, etc.

10. *Substitute power equipment.*—The commonest method of guarding against power shortage is to pro-

vide substitute power equipment. Many of the New England mills operated by water-power find it necessary to have steam plants to help out during periods of drouth. Similarly, many concerns in New York City using electric power find it advisable to continue their old steam equipment, even tho the Edison Company offers to buy it up.

Substitution is a valuable preventive in all lines, even tho the substitute is sometimes more expensive than the thing it replaces. The difference in cost will be more than offset by the saving of *time*, the most expensive factor in business.

11. *Equipment tickler*.—An ounce of prevention is worth a pound of cure. The most efficient maintenance is the replacing of a part before it actually breaks. A tickler system is a valuable aid. The best type of tickler is one which has a portfolio for each day in the year, large enough to hold all reminders. Notices should be placed in the tickler in advance to come out at proper intervals thruout the year for the examination and repairing of parts of machines, boilers, engines, belts, etc., likely to wear out or otherwise give trouble.

12. *Other methods to avoid shutdowns*.—Another method of maintenance is the annual shutdown of the plant as practised by the National Cash Register Company, the Remington Typewriter Company and other large concerns. All the operators are given their vacations at the same time, the plant shuts down and the entire equipment is overhauled. In the steel in-

dustry it has been found advisable to relieve the furnaces each Sunday, whether they need it or not, so as to prevent their burning out during the week. In the same way ships find it advisable to overhaul all machinery while in port and to replace worn parts, even tho they might last another trip, rather than take chances on breaks in mid-ocean.

No matter how carefully things are watched, occasional breakdowns are bound to occur, and the best way to minimize the loss is to be prepared for them. The stock room should always carry a supply of repair parts, and the plant should have adequate wrecking equipment, such as traveling cranes and hoists for taking out and replacing the broken machinery.

REVIEW

In dispatching work thru the factory or office what information is of paramount importance to the man who plans the schedule?

Study your own department and develop a "route-board" by means of which you could control the movement of material from point to point.

What questions are answered (or should be) by the route-board?

Design a production-sheet for some product with which you are familiar.

How do some concerns avoid the losses due to shutdowns, vacations, power shortage, etc.?

CHAPTER XXV

SAVINGS IN MATERIAL—STOCKKEEPING

1. *Stockkeeping system a necessity.*—In order to guarantee sufficient and proper tools and materials, it is essential to have a modern stockkeeping system. The duty of a stock or tool department, as described by Harrington Emerson, is to supply the *right material*, at the *right place*, at the *right time*, of the *required quality*, in the *minimum necessary quantity* and at the *lowest cost*. In addition to preserving the materials from deterioration, loss and waste, the stockkeeper must anticipate the shop's needs so as to prevent any loss of time from waiting for supplies. The supplies are furnished to the workman at his machine or desk, which he is not allowed to leave. His duty is to run that machine, for when he is away getting supplies or gossiping with other workmen at the storeroom window, his work is being neglected.

2. *Tool room in charge of expert.*—The tool room should be in charge of a tool expert who has the care of all tools and of sharpening and keeping them in shape. No workman is allowed to stop and sharpen his own tools. He must call for new ones; he is supplied with a call bell so that he does not have to go after the tools but has them brought to him. The

workman quickly realizes the justice of this plan, and when he knows that his bonus depends on his efficiency, it is interesting to see how he makes the helpers step around. Some companies even go so far as to supply each man with a standard kit of hand tools which he must use constantly, and a locker in which to keep them, instead of letting him furnish his own. For these he gives his receipt, promising to return them or their value on leaving the company's employ. The advantages of this method are:

1. It reduces the number of tools required.
2. It enables the shop to obtain exact standards.
3. It assists the shop in dictating the exact method of doing the work.

3. *Three rules of storekeeping.*—The interest on the capital released by a maximum and minimum stores system will often pay the entire expense of the department. The stores materials are commonly subdivided into tools, rough stores or raw materials, and finished stores ready for shipment. Often they are still further divided into finished parts awaiting assemblage, or possibly further divisions, as occasion demands. However, the principles of handling these classes are the same and are very simple.

There are only three operations in storekeeping: the receipt of goods, the issuance of goods to workmen and the preservation of the remainder on hand. There are only three rules of stockkeeping:

1. A receipt is to be given for all goods received.
2. A receipt is to be taken for all goods delivered.

3. Someone must be responsible for stores on hand, just as a cashier is held responsible for all cash.

4. *Receiving supplies.*—Goods are received from only three sources. The first, and by far the largest portion, is purchased from outsiders. Before being placed in stock these goods must be carefully checked as to quantity and quality, for after they are placed in stock their identity is lost. In order that the receiving clerk may do this intelligently he must be supplied with a duplicate copy of the purchase order. Where he does not have such a copy he is sure to accept shortages and wrong goods. The discrepancy may be subsequently caught by the accounting department, in checking receipts with the original orders, but after the goods have been received and placed in stock it is much more difficult to rectify mistakes and, consequently, it is less likely that any attempt will be made to do so. It is customary, however, to omit the price, which does not concern the storekeeper.

Some suspicious purchasing agents blank the quantity, thus making sure that the receiving clerk actually checks the quantity received. In all cases it is necessary to give the unit of measure; $\frac{1}{2}$ " nickel-plated ells are purchased by the piece, $\frac{1}{2}$ " galvanized ells by the pound. Unless the order states which unit is employed the check may be entirely useless, and no second checking is possible. Where goods are purchased or issued according to weight the stock clerk should be supplied with a scale. This seems obvious, yet such

simple provisions are often neglected. The best practice is to have two scales, one for heavy weights and one for light, thus securing the maximum accuracy.

Some accountants advocate placing in stock all goods received for whatever purpose and then charging them as they are issued. This is unnecessary. Where goods are ordered for special purposes it is much more direct to charge them at once according to those purposes. The order should specify for what they are to be used and where, so that the receiving clerk may be able to forward them to the proper department at once with a minimum amount of handling and delay.

5. *Receipting for goods.*—There are two methods of issuing receipts for goods received. One is to give a formal receipt to the person making the delivery. This receipt gives the order number, the date when the article was received and a description. A carbon copy is sent to the purchasing department. The second method is to O. K. and return the stock room copy of the original purchasing order. The second method would appear the better, especially in small concerns, in that it reduces the clerical worry in regard to both receiving and checking bills. The practice is, however, divided. One company, for instance, uses the original order in its electrical department, but independent receipts for its general purchasing.

The second source of supply is the manufacture of goods for stock. The production order should cover this class without any additional formalities. The

third source is unused materials returned by workmen. Credit memoranda should be issued for this class of receipts. They should be distinguished from requisitions by the color of the paper or of the printing. A common custom is to use red ink for all credit items so as to prevent confusion.

6. *Issuing supplies.*—Tools, as a rule, are easily distinguishable from materials; but they run together in such articles as brushes, files and rubber boots. Altho generally considered as tools, these articles are worn out so quickly that many managers invariably classify them as materials and charge them out as such. Each of these three classes of goods—materials, tools, consumable tools—should be distinguished and issued accordingly.

7. *How to use requisitions.*—There are two principal systems of issuing materials. The first corresponds with banking practice. If a depositor wishes cash at a bank he must issue a "counter check" on the paying teller. This is the requisition system. The storekeeper issues stores on the presentation of a regular order or requisition signed by any responsible person (Figure 23). In office stockkeeping it is often advisable to combine the requisition with the stock ledger by providing columns in the ledger for the name of the person authorizing issue and for the signature of the receiver. This lessens the clerical work and since all office supplies are charged to expense there is no object in charging the items separately.

8. *Bill-of-materials.*—The second method is to issue

the materials called for by a bill-of-materials prepared by the designing or the production department. This has the advantage of more closely meeting the actual

Form F-108 REQUISITION No. FOR DEPARTMENT SUPPLIES							
ORIGINAL							
TO DEPT. _____ Please furnish the following for Department _____							
✓	Quantity	DESCRIPTION			Weight, lbs.	Price	Amount
1							
2							
3							
4							
5							
6							
7							
8							
Date Wanted		Date of Requisition	Goods Delivered	Entered Stores Ledger	Entered Stock Ledger	Entered Cost Dept.	
If impossible to fill this requisition by the above date no- tify this depart- ment immediately.		Foreman	Foreman				

9. *Combination systems.*—Other systems, however, use a combination of these two methods. The bill-of-material should generally be used, with the requisition as the flexible element to meet emergencies and to offset clerical errors in bills. Some managers think it is better policy to issue material when it is called for by a responsible department foreman, and to adjust later any discrepancies between bills-of-material or other specifications and the foreman's statement as to his requirements. Under no circumstances should production be stopped pending adjustment of technicalities as to quantity of material.¹ If a foreman is to be held responsible for results he must be given a certain amount of freedom. Under either method the man actually receiving the materials should be required to sign for them so that he may be expected to explain any overissue which may occur.

To secure a new consumable tool the workman must return the worn-out tool that he has. To get a new brush, for instance, he must return the old one; to get a new pair of boots he must return the worn-out pair. This plan prevents the workman's being able to get new tools from the storeroom any time that he loses his old ones, and also gives the purchasing department a basis for judging the wearing quality of the goods. Replacement of defective materials and issuance of materials on account of spoiled work should be made by this method.

10. *Complete and simple system.*—The J. L. Mott

¹ Diemer, "Factory Organization," p. 118.

Company's tool-room system is complete and simple. Each man is given twelve checks which have the same number and are specially made from a reversed steel die bearing the firm's initials so they will not be duplicated. Each tool in the department is represented by a 3 x 5 filing card. When there is more than one tool of a kind there is a corresponding number of cards. A two-drawer card-index cabinet is used.

In drawer No. 1 the guide cards represent the shelving, bins, drawers, etc., of the tool room. Behind these the tool cards are placed. In drawer No. 2 there is a guide card for each man, numbered to correspond with his checks. When a man presents his check for a tool at the window, the check is hung on the checkboard and the tool card is taken from its regular place, drawer No. 1, and placed back of the workman's guide card in drawer No. 2. When the tool is returned the man receives his check and the tool card is put back in its proper place in drawer No. 1. If a tool is broken or lost the card is taken out of drawer No. 1, and after being marked "broken" or "lost" is placed behind a guide marked "broken or lost" in drawer No. 2. Thus the checkboard shows at a glance how many tools a man has and the total number of tools out. Drawer No. 2 shows what tools are in the shop and thus the need of referring to the shelves is obviated.

11. *Single and double check system.*—The simplest method of issuing tools is to give each workman a supply of brass checks, say ten. When the man gets a

tool he hands in a check which is substituted for the tool. This is the single-check system.

In the double-check system, which is in common use, each man is represented by two adjacent hooks on the tool-room checkboard. Ten round checks are issued to the man when he starts work, and ten square checks bearing the same number are hung on one of his hooks. When he calls for a tool he presents one of his round checks. This is then placed on the hook from which the round checks were taken. At the same time one of the square checks is taken off and placed in the tool rack, case or drawer from which the tool is taken. When he returns the tool he is given back his round check, and the square check is taken from the rack, case or drawer in which it had been placed as a substitute for the tool. This system enables the tool-room foreman to tell by the number of round checks hanging on any man's hook just how many tools he has out, but it does not show what tools they are, as does the Mott Company's system.¹

12. *Responsibility for remainder on hand.*—In order that the stockkeeper may be held responsible for the stock and tools on hand he must have complete authority. The stock room must be under lock and key and no one except the storekeeper should be allowed access. This is essential. Unless he is thus protected, the storekeeper cannot justly be held accountable for the stores. If two men have joint charge, each can blame the other and it is never pos-

¹Diemer, "Factory Organization," p. 159.

sible to place the responsibility absolutely. Thus, we see separate cash registers in large stores. Each clerk has a cash drawer of his own and so is responsible for any shortage in his own drawer.

13. *Stock room protects goods.*—The stock room must also protect goods from depreciation. Only heavy goods of little value should be stored out of doors, and these should be protected from the weather by sheds or tarpaulins. Finished surfaces should be greased to prevent rust even if they are kept under cover. The Robert Gair Company, paper goods manufacturers, state that one of the advantages of their new concrete building is that it annually saves fully \$5,000 which it formerly lost thru damage done by vermin.

Fire is, however, the main cause of loss, and special precautions should be taken, especially with respect to goods of value and all records. Thus in Armour and Company's office building and in other modern buildings there is a built-in fire-proof vault for office records. In the American Bridge Company's drafting room there is a fire-proof vault for drawings. Such practice is becoming universal. Where records and drawings are not thus protected a duplicate set should be kept somewhere outside the office building, as an insurance measure.

To prevent goods from being kept too long the Watertown arsenal introduced the so-called two-bin system. Two bins, A and B, are provided for each article. While the goods in A are being used, all new

goods received are put in B. When A is empty, B is started and new goods are put in A. Thus the material is used in the order of its receipt instead of its being possible for old material to collect at the bottom of the bin, as is the case when new material is dumped in on top of the old. The two-bin system is especially applicable to the handling of stationery, which yellows with age, so that often under the old system the bottom of a pile has to be thrown out.

14. *Classification by kind.*—Materials should be classed by kind, not by size. Some unit, such as 24 inches, should be adopted, and the shelves should be divided into square compartments. These compartments can then be subdivided, as the necessity arises, without changing the shelving. There are two systems involving such arrangement.

The way to number bins in stock warehouses is to divide the whole cubic volume of the house into spaces and allot a certain number of spaces to each volume, whether the volume is to contain large or small bins. In this way, no matter what changes or rearrangement in the sizes of the bins there may be, the same number will always designate the same space in the warehouse. For instance, all bins numbered in the ten thousands would represent bins in aisle 10, those beginning with 10,500 representing the bins on one side of the aisle, and those beginning with 10,000 the bins on the opposite side of the aisle. If the bins are large, of course, a great many numbers will not be used. This is practically the same principle that has been finally adopted as the most satisfactory method of numbering houses in city streets, and will be found equally satisfactory in storage and warehouses.¹

¹ Diemer, "Factory Organization," p. 114.

The placing of even numbers on one side of the aisle and odd on the other, as is done, for example, in the numbering of theater chairs, has, however, some advantages over this method.

It is also well to place near the delivery point those goods which are much used and to locate at the back of the storeroom those which are seldom used. Where this system is adopted it is necessary to have "finding lists" or card indexes giving the location of the supplies. Where the stock room is large or where there are several floors, it will save time to have several such "finding lists" at convenient points.

The second method is alphabetical and calls for an arrangement in accordance with the material or tool symbols. These symbols are marked on the end of the tiers so that anyone, even if he is not familiar with the stock-room layout, can find anything in stock exactly as he would locate a name in the city directory. This system follows the general tendency to simplify the work and eliminate the index which is discernible in loose-leaf ledgers, in card systems and in the open-shelf fiction classification of the public libraries. The procedure is the same whether a lead pencil or a blow valve, a box of envelopes or a rough casting is cataloged. Of course some kind of symbol system is a prime requisite.

15. *Size materials when checking.*—The handling of materials is facilitated by sizing materials the first time they are checked; this eliminates the need of doing it again. The Salford Rolling Mills, Man-

chester, paint the weights on all castings when they leave the foundry. The Thompson-Starrett Company paint the length of all heavy timbers on both ends so that one can tell just what is in the yard by looking at the ends of the piles. Some companies indicate the kind of steel by painting one end a certain color. The Tabor Manufacturing Company of Philadelphia paint their bolts, washers, clamps, etc., used in setting up work in machine tools, with bright colors, such as red, blue, green, which immediately designate them as tool equipment. Adequate hoists, tool boxes, etc., for the handling of the material should be provided.

16. *Stock ledger and inventory-taking.*—The stock ledger is usually kept in the dispatching or planning department to facilitate routing. Where the system of dispatching has not yet been introduced, the stock ledger is usually kept in a card or loose-leaf ledger.

Standard designs are carried in stock by most of the manufacturers of loose-leaf and card systems. A useful stock form of the C. E. Sheppard Company is shown in Figure 24. The sequence of the items varies in different companies. C. B. Cottrell & Sons place the balance between the received and delivered columns. The C. W. Hunt Company places the order number after the amount delivered but before the balance on hand. The Wells Brothers Company provides separate date columns.

In order to verify the stock on hand, the balance-of-stores clerk spends an hour a day in the storeroom checking up.

[illegible]

FIGURE 24.—STOCK-LEDGER FORM (LOOSE-LEAF).

Each day he takes a certain number of items and counts and weighs them, comparing the results with the figures on his sheets. To go thru the whole stock room requires six months, so that during the year two full inventories are taken.¹

Another method is to check each article when the quantity on hand is low; this system involves a minimum of work. Slight discrepancies are bound to occur, because fallibility on the part of a stock clerk is far more common than infallibility of records. When discrepancies are marked, or appear as continual shortage in the more valuable materials, they should, of course, be investigated, but in general they should simply be written off. In either case, that bugbear, the annual "taking account of stock," is entirely unnecessary.

17. *Losing time on cheap rather than expensive operations.*—If two men are dependent upon each other, the less expensive must wait upon the more expensive. Theoretically it should be possible for them to exactly tie into each other. Practically this is not so. Unless the cheaper serves the more expensive, the more expensive man or machine will do the waiting. For instance, if men were loading trucks with dirt, it should be possible to proportion them exactly so that one truck would drive on to be loaded while the one ahead was driving away full. As an actual fact it is not possible and under such circumstances the men will be waiting for the trucks or the trucks will be waiting to be loaded; they will be wait-

¹ E. M. Woolley in *System*, June, 1911.

ing for one another during different parts of the day. It is therefore necessary to decide which of the two causes of delay is the more expensive, and supply either enough men to keep the trucks moving or enough trucks to keep the men busy.

18. *Principles of general application.*—These principles apply thruout business. If the man's time is more valuable than the material used, he must be given a leeway; otherwise he will have to adapt himself to the material. If the material is more valuable than the man's time, he must adapt himself to the material; otherwise he will waste it. Such is the case in goldsmithing; the workbench is laid out, not so much for the man's convenience, as to save the gold filings. This reasoning applies with special force to office work. If an executive's time is worth more than a clerk's he must be supplied with a sufficient clerical force; otherwise he will be doing the clerical work himself at the expense of more important work. The less expensive unit should be made to wait upon the more expensive.

REVIEW

A visitor in a large manufacturing plant noticed that workmen were running here and there looking for materials, tools, etc. In what way could the stockkeeping department aid in cutting down the time lost by these workmen in leaving their work?

Why do some purchasing agents blank the quantity on an invoice which goes to the receiving clerk?

What economical method of issuing receipts for goods received would you advise for a small concern?

A depositor goes to a bank to draw money. He writes out his check for the amount and presents it to the cashier. What

suggestion is there in this transaction for the office or factory manager who permits employes to get their materials, tools, supplies, etc., without going to the expense of having a stores clerk look after them?

How does a bill of materials affect the stockkeeping department? the accounting department?

How do some managers check the discrepancies between a bill of materials or other specification and the foreman's statement as to his requirements?

Devise a general policy for the stockkeeping department, of such a nature that by means of it responsibility can be placed for the stock and tools, and depreciation due to exposure of materials, etc., can be held within reasonable limits.

Devise a stock-ledger form that would enable you to control the balance of stores without taking an inventory.

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